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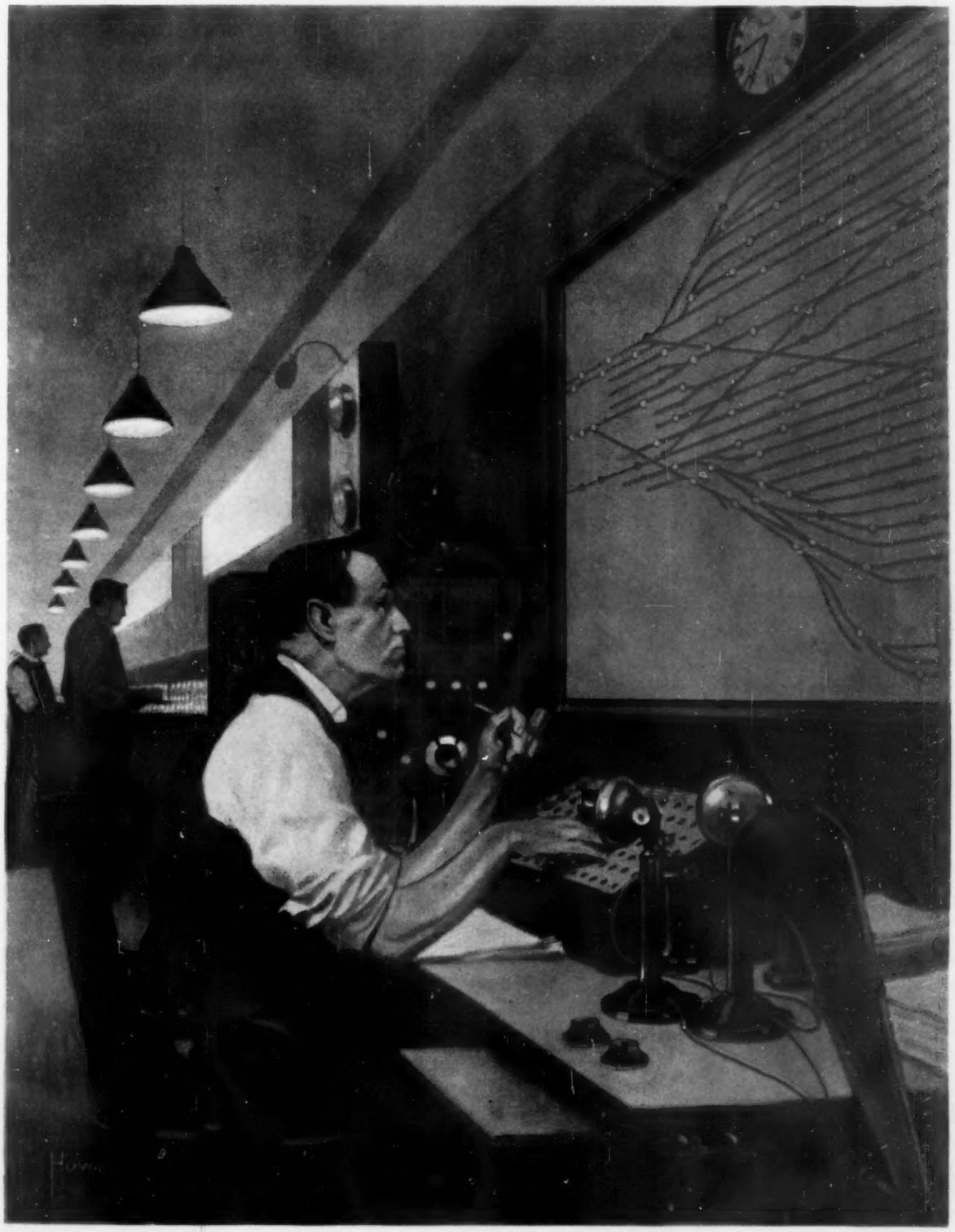
MILK WITHOUT COWS

SCIENTIFIC AMERICAN

A Weekly Review of Progress in

INDUSTRY · SCIENCE · INVENTION · MECHANICS



DIRECTING THE TRAIN OPERATIONS IN A GIANT RAILROAD TERMINAL.—[See page 329]

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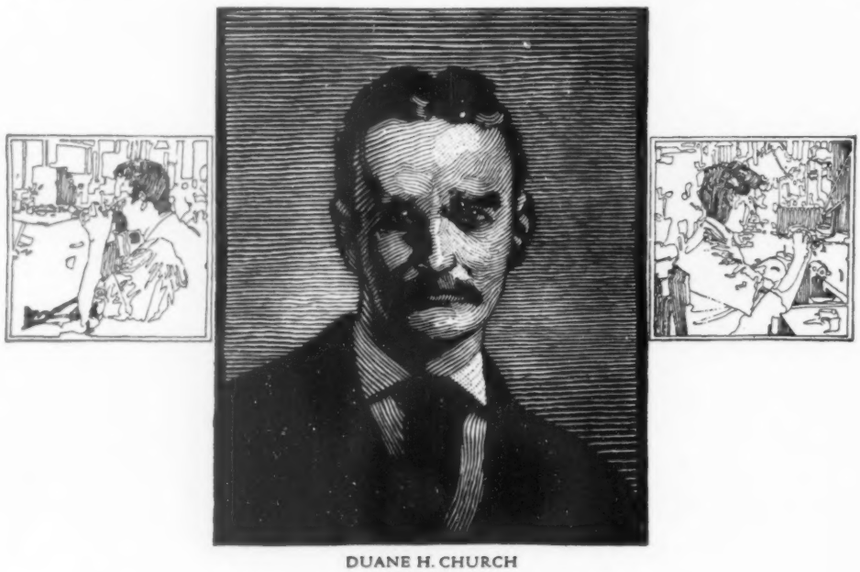
THE SCIENTIFICALLY BUILT WATCH

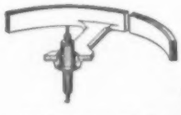


DUANE H. CHURCH
OF WALTHAM
The world's most famous inventor of watch-making machinery

ACCURACY

The Bearing of a Shaft that Measures only Six One-Thousandths of a Centimeter, the Diameter of a Normal Human Hair

Jaw Gauge



The Pivot or Shaft

WE told you in a previous advertisement that the twelfth part of a human hair was the difference between the Waltham standardized accuracy and the variable guess work in foreign watches.

A normal human hair measures six one-thousandths of a centimeter. Imagine, then, the pivots or bearings of the Balance Shaft being only the size of a human hair.

If you should split one of the hairs of your head into six equal parts, each part would measure approximately one-thousandth of a centimeter. Yet, even this minute variation is eliminated by the Waltham standard of measurement. For instance, here is a Waltham Watch, the works of which are designed to perform on a pivot measurement of six one-thousandths of a centimeter.

But suppose this pivot was enlarged the third part of a human hair, friction would be increased, causing a variation in the time-keeping qualities of the watch.

The Waltham Watch Company has created marvelous gauges that measure even the twelfth part of a human hair to determine these variations and eliminate errors unseen by the human eye in the works of a watch, which mean all the difference to you in dependability and value, giving another of those unanswerable reasons why your watch selection should be a Waltham.

WALTHAM VANGUARD
The World's Finest Railroad Watch
23 Jewels $80 and up

This story is continued in a beautiful booklet in which you will find a liberal watch education. Sent free upon request to the Waltham Watch Company, Waltham, Mass.

Makers of the famous Waltham air friction quality Speedometers and Automobile Time-pieces used on the world's leading cars

WALTHAM

THE WORLD'S WATCH OVER TIME

Where you see this sign they sell Waltham Watches

SEVENTY-SEVENTH YEAR

SCIENTIFIC AMERICAN

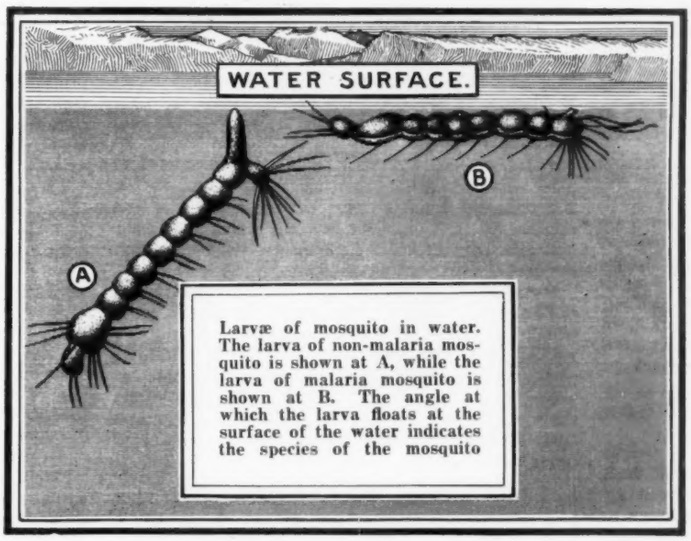
THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXXIV. NUMBER 17] NEW YORK. APRIL 23, 1921 [15 CENTS A COPY 20 CENTS IN CANADA

Man-Killing Insects

By George Philip Paul, M.D., C.P.H.

THREE-FOURTHS of all animal life consists of insects. Insects postponed the construction of the Panama Canal for many years. The tsetse fly of Equatorial Africa kills more people annually than do the African man-eating lions. The body louse or the world-famed "cootie" was the cause of more deaths among the Serbian people during the Great War than were bullets. The "tiger" mosquito of Central and South America brings about a heavier annual mortality than do the many revolutions for which those parts of the world are noted. The common house fly yearly blots out the lives of thousands of innocent babes and young folks. The Anopheline mosquito of our southern states is accountable for a great many deaths and more cases of invalidism. The rat fleas have slain their millions by the dissemination of bubonic plague. And so, many other startling data might be rehearsed. But while a spectacular epidemic of influenza which kills its thousands will aronse the whole world, the death-dealing insects which are yearly responsible for hundreds of thousands of lives are relatively given but scant attention.



Larvæ of mosquito in water. The larva of non-malaria mosquito is shown at A, while the larva of malaria mosquito is shown at B. The angle at which the larva floats at the surface of the water indicates the species of the mosquito

Yellow fever, which is solely carried by a type of mosquito known as the "tiger" mosquito from its peculiar markings, or more properly as the *Aedes calopus*, is a disease of American origin. Not only is it carried exclusively by this type of mosquito, but solely by the female of the species. The mosquito must have bitten the person ill with yellow fever during the first three days of the disease and then a developmental period, within the insect, of the organism is necessary before the infected mosquito may give the disease to others. After a person is bitten by an infected mosquito the symptoms do not appear until two to six days elapse.

Yellow fever was one of the diseases that delayed the construction of the Panama Canal. Surgeon-General Gorgas cleared the canal zone of mosquitoes and yellow fever and made the rapid completion of the canal possible. Later General Gorgas rid Havana of this menace and at the time of his death was engaged in the eradication of yellow fever. While the disease is native only on the Caribbean Sea littoral and the West African coast, where endemic homes of yellow fever are located, the tiger mosquito has been found in the East Indies, in the Philippine Islands, China, Japan, southern Europe, Africa and Australia. The infected mosquito brought to these parts by a vessel may therefore become the spark to start a yellow fever conflagration.

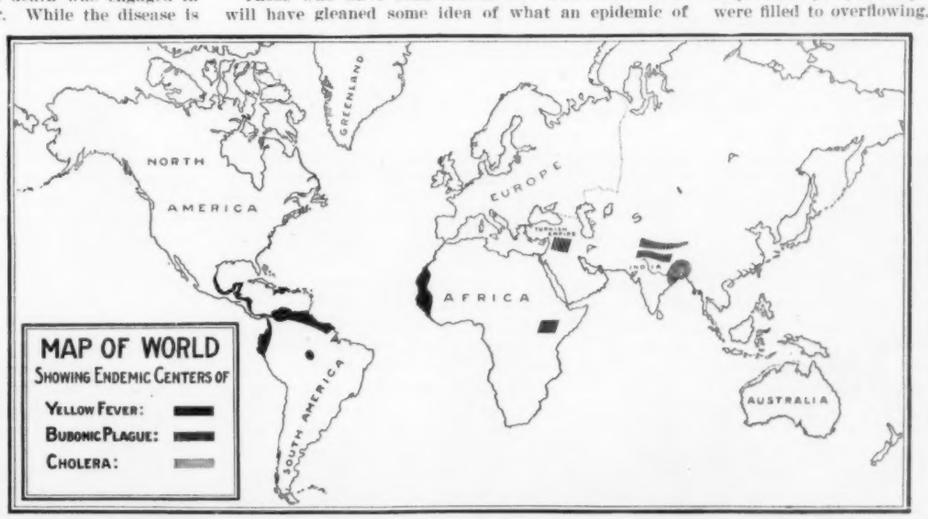
A Dead Rat!

This cry in an Oriental city may herald a great outbreak of the plague. Plague is a rat disease transmitted to man by the rat flea. Before the occurrence of a plague epidemic in a city, there may be an extensive epizootic of plague among the rodents, especially the rat. These animals will die in great numbers. One can understand why the finding of dead rats in an eastern city may almost create a panic. The flea will not as a rule leave the rat until after the rodent's death. The flea derives its infective material or plague germs from the blood of its host the rat. The germs collect in the stomach of the insect where they multiply so rapidly as to prevent the flea from swallowing its food. To relieve itself the flea ejects the mass of germs through its mouth and may thus infect the rat or person upon whom it is living.

Fleas are wingless insects and move about by series of jumps. The eggs do not remain on the body of the rat but fall to the floor and there are hatched. The young forms of the insect exist on the accumulation of dust and filth that collects on the floor and continue their development to the adult form, which soon takes up its abode on the rat. Plague is said to be endemic in the ground squirrels of California.

Those who have read Atkinson's "Old Saint Paul" will have gleaned some idea of what an epidemic of plague means to a city. In 1665 London was visited by a very extensive outbreak. Authorities state that nearly one-seventh of the population perished during this epidemic. Three hundred years previously the great pandemic of "black death" overran Asia, northern Africa, and Europe and collected as its toll the lives of twenty-five per cent of the inhabitant of Europe besides tens of thousands in Africa and Asia. Plague has invaded New Orleans and California. The last great outbreak of this disease occurred in Manchuria in 1910.

There are four endemic centers of plague—that is, localities where the disease is always present and from which seed may be derived for an extensive outbreak in other parts of the world. One of these endemic centers is in Mesopotamia, two are in the regions of the Himalayas, and the fourth is located in Uganda, Africa. The fight against plague is necessarily a fight against rats and their tenants the fleas. A systematic campaign is carried out in plague-infected cities with the object of eradicating the rat population that may be suffering from the plague. The rodents are trapped, shot, poisoned, drowned, and hunted with dogs. Their feeding places are destroyed. Buildings are made rat-proof. In fact everything is done to bring about rat eradication. Ocean vessels harbor myriads of rats and may thus carry plague from port to port. To prevent rats from leaving a vessel, the hawsers are provided with metal disc shields and the gangways are vigilantly guarded during the day and raised at night. Fumigation of the interior of the vessel at regular intervals will keep its rat population at the minimum.



The Body Louse and Typhus Fever

Soon after the commencement of the Great War the Serbian army captured great numbers of Austrian prisoners and with them Serbia received the seeds of a vast epidemic of typhus fever. The disease spread like wild fire and soon the little country was a seething mass of sickness. Her heroic doctors died in the midst of their efforts; the stricken Serbs lay ill in the highways and byways; hospitals and improvised hospitals were filled to overflowing. The Austrians with the aid of the body louse had brought Serbia more quickly to the verge of defeat than they could have hoped to do with all of the heavy artillery that they possessed.

In parts of Mexico this disease is constantly found. At one time Ireland was sorely tried by it; in the early eighties New York and Philadelphia experienced epidemics. The disease is transmitted from person to person by the common everyday body louse or "cootie." During the late war very many of our soldiers engaged in active warfare were infested by the body louse. *Pediculus vestimenti* is the fancy name of this little pest. He principally takes up his residence in the underclothing and makes

(*Continued on page 335*)

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The Hudson River Bridge

INSCRIBED over the portals of an early and famous suspension bridge in Europe one may read the inscription, *Via Suspensa Difficile Fit*, of which a very free translation would be, "It is no small task to swing a highway through the heavens." Doubtless the aborigines thought so when they first spanned a stream with their elementary suspension bridges built of the tough tendrils of trees and followed these with more ambitious structures built of cables woven of twisted fibers.

The comparatively small strength of such materials set a stern limit upon the length to which these early bridges could be built, and there was a long wait through the centuries until the dawn of the iron age presented the bridge builder with a material which enabled him to construct more daringly. And so it came about that in 1820 the famous engineer, Telford, by forging his iron into long, flat eye-bars, was able to build the famous chain-cable suspension bridge 1,000 feet in length which carried the post road to Holyhead across the Menai Straits by means of two shore spans, and a main span across the channel which is 590 feet in length.

But the iron chain cable grew so greatly in weight as its length was increased that we had to wait until drawn wire presented the engineer with a material that was so strong in proportion to its weight as to open up greater possibilities in the building of long-span suspension bridges; and that distinguished engineer, Colonel Roebling, availing himself of the new material, did not hesitate to connect Manhattan and Brooklyn by a bridge whose main span measures 1,595 feet between its supporting towers.

Further developments in metallurgy and the art of steel manufacture, particularly in the direction of alloyed steels, has so greatly extended the possibilities of long-span construction that today, in the bridge designed by Lindenthal to span the Hudson River, we have a structure whose main span is double that of the Brooklyn Bridge, its floor space five times and its live load capacity fifteen times as great.

If that engineer of an earlier day could come back, seven years hence, and look upon the completed Hudson River Bridge, he would feel, surely, that his Latin inscription could be placed above the portals with a stronger emphasis and a more profound significance than he himself had ever dreamed of. And yet, to do him justice, it should be written here that progress in the science and technique of engineering has made such strides that the task of swinging this broad highway through the heavens, great though it be, is no more difficult to the engineer of the twentieth century than was the feat performed by the bridge builder of one hundred years ago.

Return of the Clipper Ship

ARE we on the eve of another clipper ship era? Is the stubby tramp steamer, lumbering from port to port at nine knots an hour or less to give place to the shapely fore-and-aft schooner, capable of doing her fourteen knots in a breeze and maintaining (thanks to her auxiliary motor) an average of ten to eleven knots for the whole voyage?

An answer to this question is suggested in the article on page 326 of this issue, in which it is shown that the survival of the steam or oil-driven ship is a question of the cost of operation, particularly with reference to fuel cost. In this connection we draw attention to the last report of the Chamber of Shipping of the United Kingdom, which says: "Under present conditions very little shipping is being run at a profit; on a great many recent voyages heavy losses have been incurred."

It was similar causes, though they were not nearly so severe, which led to that marvelous outburst of sailing ship activity which has come to be known as the Clipper Ship Era; and unless there should be a very great reduction in fuel and labor costs (of which there is no evidence today) the sailing ship, except for fast freight and passenger service, must once more come into its own. Should this happen there need be no anxiety on the score of speed; for the square-rigged clipper ships of the fifties were fast—very fast—and since their day there has been developed an American type that is faster yet—the big fore-and-aft schooner.

The clipper ship in a breeze was able to show her heels to the steamers of her day and her average speed was superior. Consider the "Flying Cloud" which in 1851 sailed from New York to San Francisco in 89 days, during which voyage she covered a continuous stretch of 5,912 miles at 9½ knots and another of 1,256 miles at 13½ knots. Later "The Lightening," in a gale, sailed 436 miles in a day, her speed rising at times to 18 and 18½ miles by log. These were not large ships, their lengths being respectively 225 and 244 feet.

Today we could do much better. We have steel in place of wood for hull and masts; wire rope for all standing and running gear, to say nothing of the refinements in hull, sails and rig which the yacht designers with their long experience could work into the design.

Furthermore, the square-rigger could not lie closer to the wind than 6 points. She sailed 100 miles in going 38 miles to windward, and in calms she lay dead. Our modern steel fore-and-after would lie up within 4 points and she would make 70 miles on her course for every 100 miles through the water; while in calms she would be good for 8 knots. Finally, she would be from 300 to 400 feet in length, and other things being equal, means speed.

Can Airplanes Destroy Battleships?

THE vigorous testimony before the Senate Naval Committee of Brig.-General Mitchell, of the Army Air Service, backed up as it was by the equally confident testimony of Rear Admiral Fullam, exploded in the ordinarily sedate atmosphere of that deliberative body with something of the shock of one of the General's own bombs. Both these gentlemen represent that advanced school of thought which refuses to believe that the thing which has been must always continue to be; and they gave concrete expression to their convictions by telling the Committee that so rapid has been the advancement of aviation that within a few years' time the capital ship will be bombed off the surface of the sea.

One outcome of the discussion was the determination to put the matter to the test by providing a battleship as a target and giving the Army and Navy Joint Board free rein to carry out an experiment on a full-size scale. Preparations for the bombing of the ship on the part of the Army Air Service are being carried on at Langley Field, Virginia, where some sixty officers, chiefly students of the Field Officers' School, are engaged in bombing exercises, using the new Glenn Martin bombing airplane, which has recently been delivered to the Air Service.

Although the bombing of the battleship is to be carried out in all seriousness, it will not be possible to reproduce the conditions of actual battle; first, for the reason that in an engagement the modern battleship will be moving at a speed of something over 20 knots and on a zigzag course; and secondly, because the anti-aircraft guns of the ship will be played upon the bombing machines as they pass over. The airmen, it is true, profess to have supreme contempt for the efficiency of aircraft fire, and in the testimony before the Senate Naval Committee they pointed to the fact as did some of the admirals who gave testimony, that the record of hits of airplanes in the Great War was only one hit per thousand shots fired. Also, if the battleship that is used in these tests should be under way at the time of the bombing, and be steered by wireless on a zigzag course, the airmen claim that this movement will be actually favorable to hitting, because the planes will fly with the ship and their relative speed in passing over her will be reduced.

As a matter of fact, the crucial question is that of the elevation at which the bombs are let go. If the plane flies high, the chances of a hit are proportionately reduced. If she flies low, the velocity acquired by the bomb is proportionately reduced. It has always seemed to us that to cripple a battleship sufficiently to throw her out of line, it is absolutely necessary that the bombs penetrate the protective deck before they detonate. The dilemma may be stated thus: Flying high means no hits; flying low means no penetration.

Now, if penetration of the protective deck is necessary, we run up against the difficulty that the greater part of the weight of the bomb must be given to the metal of which it is composed. In other words, the bomb must take on the characteristics of the shell from a high velocity gun. Its walls must be made thick enough to hold together until penetration has been effected. This would mean such a great reduction of the TNT content that the huge airplane bomb would be robbed of much of its power. Again, it must not be forgotten that before reaching and penetrating the protective deck, the bomb would have to pass through two and possibly three steel decks of considerable thickness, and, so far as we are aware, there is no delay-action fuse existing which is sufficiently insensitive to stand this succession of shocks without letting go.

All of which seems to show that one of the first things the advocates of battleship destruction by bombing must develop in what we might call a super-delay-action fuse.

Patents Secured by Officers of the Government

"AN officer of the United States Government does not dedicate his invention to the public when he secures a patent without payment of Government fees."

This is the opinion of the Attorney General of the United States in answer to a written request of the Secretary of War, dated November 24, 1919. The Act under consideration reads as follows:

"The Secretary of the Interior and the Commissioner of Patents are authorized to grant any officer of the Government, except officers and employees of the Patent Office, a patent for any invention of the classes mentioned in Section forty-eight hundred and eighty-six of the Revised Statutes, when such invention is used or to be used in the public service, without the payment of any fee; *provided*, that the applicant in his application shall state that the invention described therein, if patented, may be used by the Government or any of its officers or employees in the prosecution of work for the Government, *or by any other person in the United States, without the payment to him of any royalty thereon, which stipulation shall be included in the patent.*"

The Act, therefore, expressly states that the invention may be used "by any other person in the United States."

In the opinion given by the Attorney General, he carefully reviews the statutes having a bearing upon the subject and states that, so far as he knows, there has been no decision of the courts upon the question. He is clearly of the opinion, however, that the Act was intended to encourage officers of the Government to patent their inventions and grant unto the Government the free use thereof, but that the Act did not intend that any one in the United States should have the right to make and use the invention for his own benefit or for the benefit of others.

It would, therefore, appear that it is a dangerous matter for any one apart from the Government itself or a person, firm, or corporation, who is making or using the invention for the benefit of the Government, to attempt to manufacture and sell a patented article, even though such patent be granted to an officer of the Government under the provisions of this Act.

The opinion of the Attorney General appears to be a logical one, that an officer of the Government is entitled to such benefit as his patent grant may give him, in so far as such benefits accrue from the manufacture, sale and use of the invention by parties not connected with the Government and intended for private benefit.

It is, therefore, clear that the common and well-accepted idea that a patent granted to an officer of the Government without payment of Government fees is public property free to be used by any one, is a wrong interpretation of this Act.

Automobile

City Bus Lines Opposed.—Opposition was recently forthcoming by the Merchants' Association of New York to the establishment of organized motor omnibus lines in competition with existing means of transportation. The association insists that the competition would result in impairing present traffic without at the same time providing an adequate means of handling the traffic. Among the reasons given for opposing the introduction of any more motor omnibus lines in New York were the following: (1) Increased congestion; (2) increased cost to the city for street crossing protection; (3) increase in danger and in accidents as shown by England's statistics for London; and (4) that no emergency exists which calls for the establishment of motor omnibus traffic, other than the Fifth Avenue lines.

Trucks Assist in Moving Steel. — Reports from Youngstown, Ohio, show that motor truck movements continue to play an important part in the reduction of the piled tonnage of the steel mills of the Mahoning Valley. Accumulation of unshipped finished and semi-finished iron and steel products of the Mahoning and Shenago valleys several weeks ago amounted to 7,500 cars as against 7,900 cars the week before and 8,500 cars four weeks ago. In addition to movement of the curtailed current production, the warehoused tonnage was also being moved during the last four weeks at a most encouraging rate, although most of this reduction in the unshipped tonnage was largely due to improved rail conditions. Trucking of steel to fairly distant points for rail shipments, and direct to nearby and distant consuming points is being vigorously pushed. The use of motor transportation has ceased to be a wonder in the steel industry and excites little comment in this valley now. It has however demonstrated that the motor truck generally used in this territory was not especially designed for steel shipments and it is expected that the truck builders who take advantage of this and send their engineers and designers into the territory can develop trucks that will meet the need.

Many Kinds of Knocks.—One of the most irritating things to a motorist is a knock somewhere in the car. Some knocks are so baffling to locate and remedy as to give unceasing trouble even to the experts of the garage and service station. But with care the owner may find and eliminate the ordinary causes. Perhaps the most frequent kind is that which comes from carbon deposits. With low grade fuel, such as the motorist is compelled to buy at the present time, there is every chance for carbon to accumulate in the combustion chambers and on the piston tops. Faulty carburetion, poor lubricant and poor compression due to worn piston rings facilitate its production, and many engines, even in high-grade cars, have a tendency to accumulate carbon. This is especially noted if the oiling system operates at considerable pressure. Most high-powered engines are constructed for as high compression as possible; in fact, this is carried almost to the point of pre-ignition. Then, when a film of carbon forms in the combustion chamber, it raises the compression so there is pre-ignition and consequently a knock. One should not jump to the conclusion, however, that every knock is caused by carbon deposits in the engine. Not all knocks are damaging to the engine, but some of their causes, such as a loose connecting rod bearing, a loose cylinder, or a broken moving part, might prove immediately injurious.

Notes on Skidding.—There are two main facts regarding skidding that are apparent to anyone who drives a car. One is that a car skidding sidewise on the rear wheels slides over the smooth surface to a point where the surface is rougher and the tires begin to take hold. The skid, however, does not stop immediately at the first rough spot, but due to momentum and the weight of the car, grinds the rubber over the rough spot a certain distance which has the effect of a rasp being used on the tires. This is particularly the case when the wheels are locked. It is a well-known engineering fact that railway cars with steel wheels running even on a glassy surfaced rail will, if the wheels be suddenly braked while the train is in motion, flatten a spot on the steel rim in a short time, so much so that the succeeding pounding of this flat spot will eventually split the rim. It is easy to imagine the effect on a rubber tire under the same action on a road surface when the car is braked suddenly when traveling in a forward direction. The wheels lock instantly, but the momentum and weight of the car drag the hot rubber along on the flat spots on the rear wheels. The placing of the hand on these spots immediately after will convince one that this does not need to occur very often materially to injure the tire. With chain equipment and common sense driving, the car need not even start to skid and thus grinding of the tires is unnecessary.

Science

Beer Vat Mushrooms.—The raising of mushrooms in one-time beer vats is coming into considerable prominence. Probably no other industry is more profitable that could be carried on in an ante-Eighteenth Amendment brewery. This "infant industry" is already asking for tariff protection.

Sailing of Cope Expedition. — Commander John Cope of the British Imperial Expedition, which hopes to reach the South Pole by airplane, has sailed from the Falkland Islands. The western shores of Weddell Sea will be surveyed and charted and other scientific investigations will be carried on.

Big Game Protection. — Work of marketing the boundary of Mount McKinley National Park as the first step in establishing protection over the region which is described as the fountain head of the big game herds of Alaska will begin as soon as the weather permits, the National Park Service announces.

Skin Disease of Cathedral Windows.—York Minster, one of the most beautiful cathedrals of England, famous for its glorious stained glass, is in trouble. Some mysterious disease has attacked the stained glass. It takes the form of minute holes which in time deepen and cause the glass to flake. Some portions are as thin as tissue paper and crumble at the touch. No one knows a cure.

Oil Fumes Put a Town to Sleep.—A curious result of a railroad accident in which 8,000 gallons of naphtha were spilled, is reported from Roelofs, Pa. The oil ran into a pit and the odor was so penetrating that cattle died and one man succumbed. As time went on the inhabitants of the town were attacked by a sleeping sickness and everyone began to drowse. A number of the residents moved out of town until the naphtha had dried up.

A Wild Life Refuge.—The Rockefeller Foundation has presented to the State of Louisiana a tract of country comprising some 35,000 acres known as the Grand Chenier Wild Life Refuge. The land was purchased by the Foundation from individual holders in 1914 in order to preserve the wild life of the country, and it is a condition of the gift, which includes laboratories, publications and equipment connected with the preservation enterprise, that the tract shall remain as a perpetual wild-life preserve.

A Mean Thief.—Platinum was not always as precious as it is today, and formerly it was extensively used to tip lightning conductors. Italy has been having an epidemic of church steeple climbers who filch the rare metal from the conductor tips, but Paris with its much-vaunted police system ought to have been immune. Some enterprising burglars scaled the tops of both towers of Notre Dame and stripped the top of each conductor of about six ounces of platinum. No trace of the thieves has been found, but the police think they were ex-steeple jacks gone wrong.

Fruits from South Africa. — Fruits from South Africa are the latest novelty in the New York City food markets. Not only do the African fruits appeal to the palate of those who long for peaches, plums and melons of summer time, but they are a delight to the eye. Strange crosses of peaches and plums and apples have resulted in colors of deep red splashed with yellow in odd shapes that are unfamiliar to most of us. The fruits are all carefully selected and packed in excelsior. They come under refrigeration, mostly by way of England, the trip taking a minimum of four weeks.

A Scientific Drug Expedition.—An expedition led by Dr. Rusby of Columbia will visit the unexplored areas of Venezuela, Bolivia, Ecuador and eastern Colombia. The enterprise, which is strictly scientific, is being financed by a Philadelphia chemical company and will consume eighteen months. The explorers will attempt to study and bring back for further examination here specimens of birds, insects, flora, reptiles, fish and other creatures that abound in those regions. They also will seek new light on tropical diseases, their origin and their cure. The results of the expedition will be given to the world.

Difficulties of the Heidelberg Observatory.—The annual report of the famous observatory on the Königstuhl, near Heidelberg, for the year 1919, paints a gloomy picture of the affairs of that institution. Suspension of service on the tramway leading to the observatory has imposed great hardships on the staff besides making it impossible to secure labor for making needed repairs. Lack of heat has led to much damage by dampness. Photographic work was reduced to a minimum on account of the expense of plates. Nevertheless considerable work was carried on, and the achievements of the year included the discovery of 28 new asteroids.

Aeronautics

A British Giant.—It is understood that the British are trying their hand again at giant aircraft, this time a flying boat which will be called the "Titania," and which will be fitted with four Rolls-Royce "Condor" engines as originally intended, developing a total of 2,400 horsepower.

Japan's Air Routes.—Great interest is being displayed by the Japanese in the development of commercial aviation. It is stated on good authority that the Japanese have placed substantial orders with the British for airplane engines and parts and for flying boats of British construction. Manufacturers of airplanes and their accessories are going to Japan to open up business with the Japanese, whose ultimate object is to establish land and coastal routes for commercial purposes in various parts of the Eastern Empire.

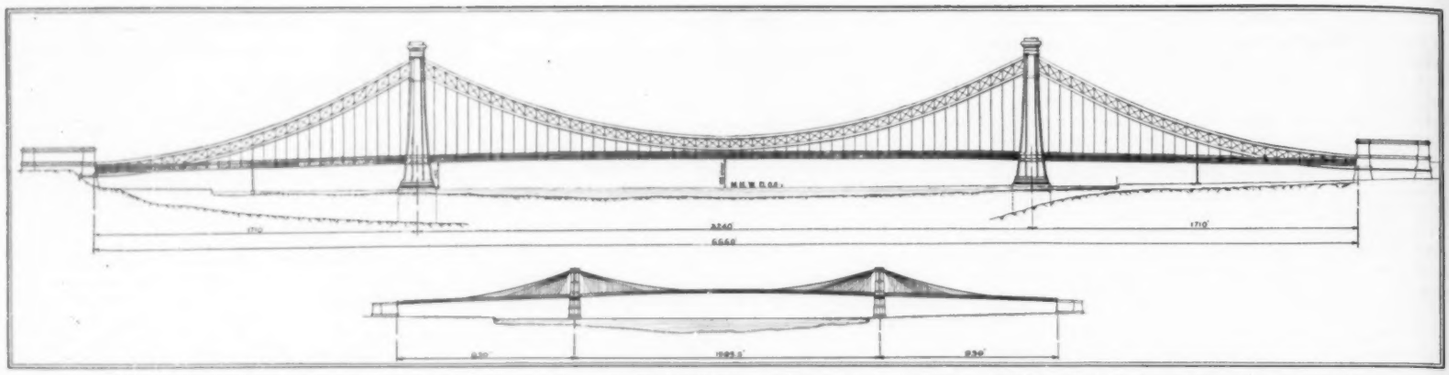
Airplane Service Between Amsterdam and Paris.—On April 14th last an airplane passenger service began between Paris, Brussels, and Amsterdam, which is to be extended at a later date to Copenhagen, and will also include Bremen and Hamburg. Daily a machine leaves Paris at 11 A. M., making landings at Brussels and Rotterdam, and arrives in Amsterdam at 3:30 P. M. An airplane leaves Amsterdam daily at 9 A. M., and arrives in Paris at 1:30 P. M. Thus the journey consumes only 4½ hours—one-third of the time now required by railway.

British Airplane Factory in Japan.—A group of British airplane construction experts has arrived in Nagoya, Japan, according to a recent report, under a three-year contract with a Japanese company, in order to supervise the construction of airplanes in all details. It is expected that a complete manufacturing plant will be organized, capable of turning out the most approved type for all purposes. Though the entire building construction of the company will probably not be finished for two years, it is understood that the building of motors and assembling of planes will be started in certain units of the plant as they are completed.

Germany's Aviation Industry.—When the war ended, according to *Aeronautics*, Germany had some 40 airplane factories at work, which were turning out about 2,500 machines a week. After the defeat of Germany and the subsequent revolution, the majority of these firms switched over to other work. Three firms decided to manufacture machines for civil aviation. These were the Sablatnig Company of Berlin, the Junkers Company of Dessau, and the Fokker factory of Schwerin. The Germany Government is watching these developments closely, though present conditions do not allow it to take any open part in furthering the building of airplanes. The industry is encouraged to maintain its factories at a state of efficiency which will enable it to go ahead immediately when the time comes. The skilled labor is being kept employed.

Kite Balloons for Commercial Use.—Although there are undoubtedly important uses to which kite balloons can be put, some very impractical suggestions have recently been made by enthusiasts for this particular craft regarding its commercial use. The value of the kite balloon in connection with meteorological observations is undisputed, and, under certain conditions, as landmarks on air routes kite balloons may be of the greatest assistance, but the suggestion that they should be towed from trawlers to "spot" shoals of fish is not quite so acceptable, we are reminded by *Aeronautics*. The small airship probably has greater possibilities in this direction than the towed captive balloon, but the present cost of an airship makes its use impracticable, nor is the speed of a small airship sufficient to insure more than occasional use. Another suggestion which has been put forward is that firms should use kite balloons for displaying advertisements.

The Caproni "Nineplandem", as the giant Caproni flying boat has been nicknamed from the fact that it has three triplane sets of wings arranged one behind the other, made its first flight on March 2nd, according to latest reports. The machine is stated to have got off well and to have risen to a height of 20 feet. This indicates that no attempt was made to fly the machine, the tests being merely to test the "planing" capacity to see if it were possible to "unstick." In addition to the pilots and mechanics, the machine is stated to have carried about 1½ tons of ballast to represent some of the 100 passengers which the machine is designed to carry. On March 4th, we learn through *Flight*, it was announced from Milan that the Caproni "Nineplandem" made a second test flight, but that in descending something went wrong and the machine made a bad alighting on the water. The pilot and mechanics were uninjured, but the machine is said to be pretty badly damaged.



The towers of the Hudson River Bridge are of the same height as the Woolworth Tower. They will be built of steel and clothed entirely with smooth-dressed gray granite

Side elevation of the proposed Hudson River Bridge and of the Brooklyn Bridge drawn to the same scale

The Hudson River Bridge

A Great Highway for the Steam, Rapid-Transit, Motor-Truck, Automobile and Trolley Traffic That Crosses the Hudson

AT last, after many delays, the latest of which was due to the war, the preliminary work necessary for the construction of the Hudson River Bridge is well under way. A staff of engineers which includes some of the most distinguished men in the country has been formed, and back of the great work there is a group of leading financiers, railroad men and others who have a wide practical acquaintance with transit problems.

The traffic situation in New York and vicinity labors under many disadvantages, and by far the greatest of these is the existence of the broad stretch of the Hudson River, cutting off Manhattan Island, the heart of New York, from the mainland and its vast network of railroads. Once this obstacle has been removed, the traffic problem will be solved. That has always been well understood. The outstanding question has been how best to accomplish this, and it was with an undeniable touch of genius that Gustav Lindenthal conceived the problem of connecting Manhattan and New Jersey, not by a series of separate structures, but by one vast bridge whose proportions would be such that it could easily take care of the whole of the traffic which surges to and fro between Manhattan Island and the mainland.

It was not idealism or any striving for the spectacular that led to the conception of this bridge upon such a gigantic scale. Rather, its dimensions have been determined by the severest application of the principles of economy. In all constructive engineering work, whether upon land or sea, it has been proved over and over again throughout the past decades that there is economy in concentration. We see it in the 900-foot steamer, the 400-ton locomotive, the 100-ton freight car, the multi-storied office building, and in the huge factories which are characteristic of American manufacturing industry. Similar economies both in the first cost and the cost of operation, will be achieved by solving the vast traffic and transportation problem between the Western continent and Manhattan Island, by the construction of a single bridge of unprecedented dimensions. Our illustrations are the first official drawings of the great structure to be made public. For purposes of comparison, an elevation and cross section of the Brooklyn Bridge are shown on the same scale; and anyone who has been impressed with the magnitude of the older bridge will quickly sense the stu-

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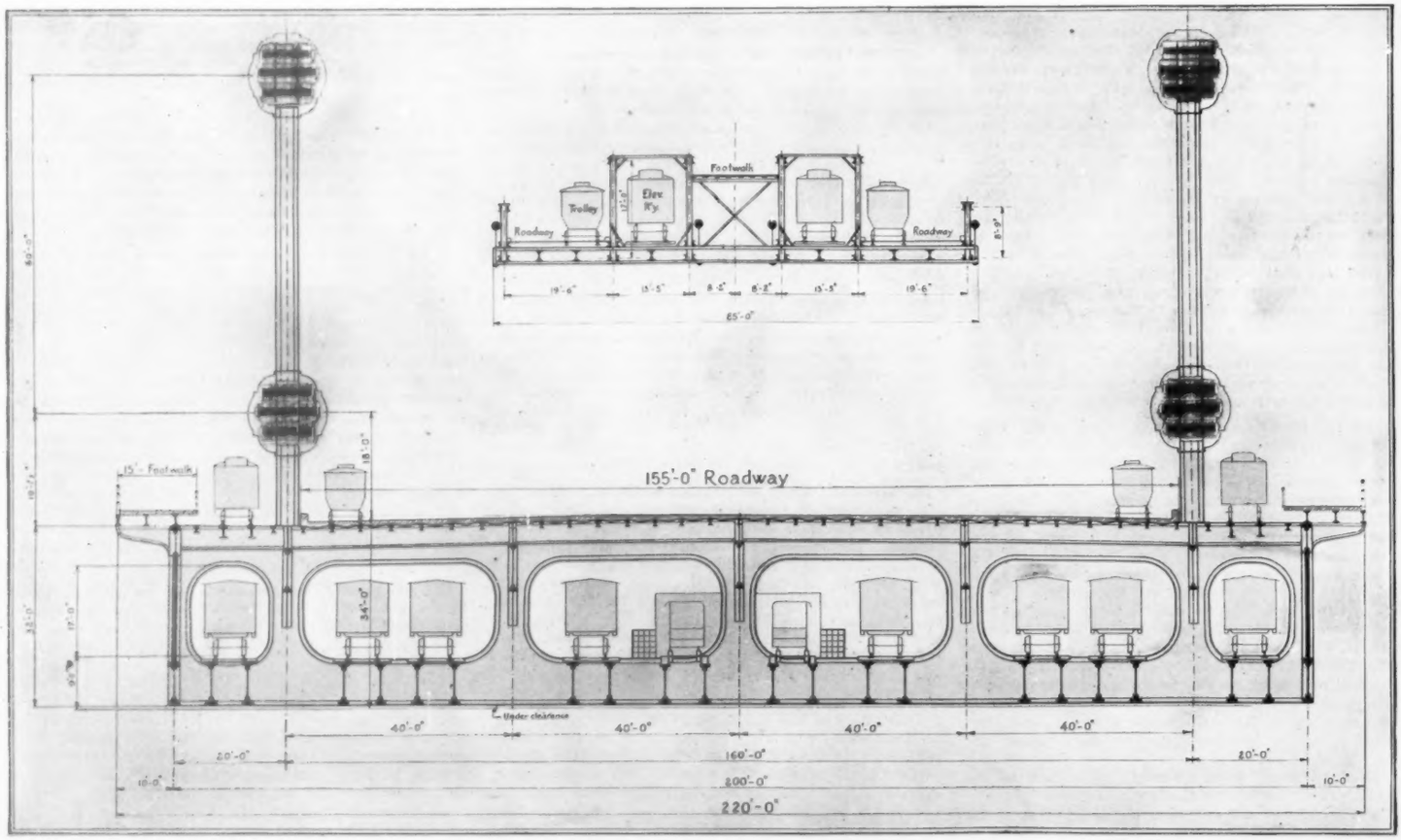
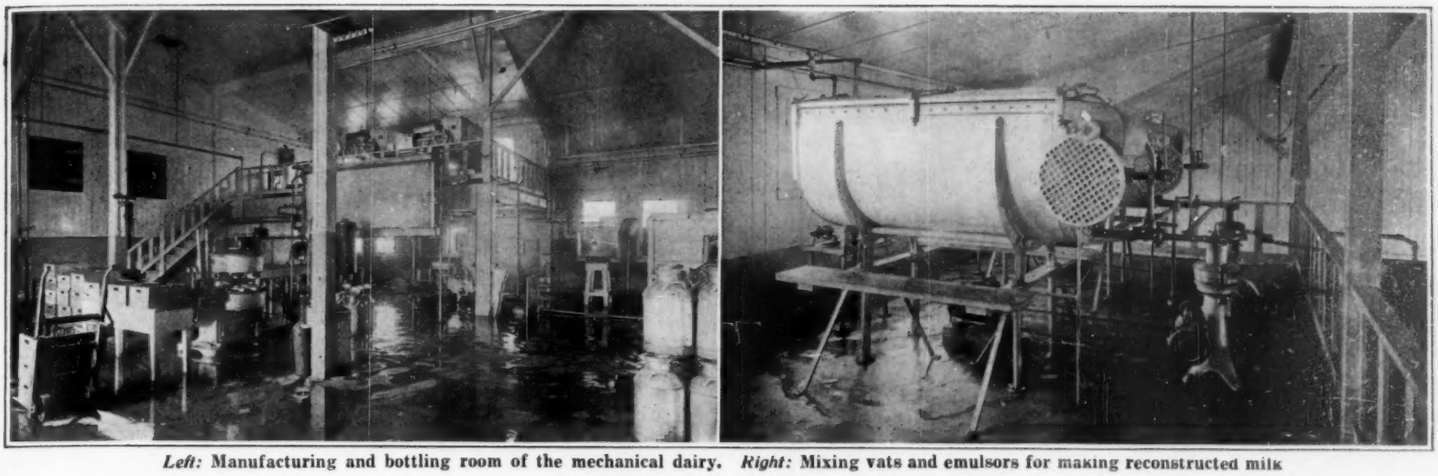


Each of the four cables will consist of three banks of steel eye-bars, enclosed in watertight bronze tubes, to protect them from the weather. Each pair will be braced together to form a deep stiffening truss. At every 60 feet will be suspended a massive plate-girder floorbeam 32 feet deep and 200 feet long. Framed in between these will be the longitudinal stringers of the two decks. The upper deck, 220 feet wide, provides for two passenger footways, two trolley and two rapid-transit tracks, and a boulevard for motor truck and automobile traffic of 155 feet clear width. This floor will be watertight and will completely cover in the lower deck, on which will be ten railroad tracks for main line freight and passenger trains

Cross-section of the Hudson River Bridge compared with that of the Brooklyn Bridge



Left: **Manufacturing and bottling room of the mechanical dairy.** *Right:* **Mixing vats and emulsors for making reconstructed milk**

Milk Without Cows

By S. R. Winters

A MECHANICAL dairy—affording an adequate milk supply to a city of 25,000 population in the absence of cows—is a commercial reality hitherto unheard of, a triumph emerging from war-created difficulties in Nitro, W. Va. It was the first commercial demonstration of the possibilities of producing fluid milk from a cowless dairy in the United States.

I hasten to explain the significance of the coined phrase, "mechanical dairy," lest the reader ponder the question originally asked by the SCIENTIFIC AMERICAN when the subject was submitted in a skeletonized form, "Just what do you mean by this term?" Technically described as reconstructed milk, the product is made by the emulsification of butterfat in normal skimmed milk. Reconstructed skimmed milk is obtainable either by diluting unsweetened condensed or evaporated skimmed milk with distilled water or by dissolving dried skimmed-milk powder in distilled water. Skimmed-milk powder was used in the Nitro manufacturing establishment as a source of solids not fat, and a first-rate quality of unsalted butter as a source of butterfat. The percentage of fat and solids not fat were proportioned in accordance with the different products being manufactured. Reconstructed milk, reconstructed cream, ice-cream, and fermented milk products, such as cultured buttermilk and cottage cheese were produced by the war-created mechanical dairy.

A liquid closely resembling milk and cream as the result of emulsifying butterfat obtained from unsalted butter in a solution of skimmed powder-milk or diluted evaporated skimmed milk had previously appeared on the market. The procedure is popular with the ice-cream industry, and Army field hospitals as well as battleships have produced limited quantities of the fluid. Then, too, the National Dairy Show has frequently exhibited this liquid as a method of advertising milk powders. Success in obtaining a satisfactory product on a small scale was responsible for the assumption that operations of magnitude could be undertaken with reasonable expectations of obtaining a liquid that would at least answer the emergency.

Dairy cattle were scatteringly distributed in this mountainous region of West Virginia, a cow to the family obtaining rather than in immense herds as are maintained in Wisconsin and the Middle West. Congestion of railway facilities rendered uncertain the delivery of a potential source from the dairying communities of Ohio. In a word, a city of 25,000 inhabitants was without any visible milk supply. The United States Public Health Service shouldered the responsibility of devising ways and means of coping with the unforseen contingency. The inviting environments amid which the undertaking was launched are obvious—absence of competition with the contents of the milk pail, assurance of a responsive market, and no violation of traditional health regulations. Yet it was with some trepidation that the procedure was authorized in view of the existing laws in the interest of health which prohibit the modification of natural food products. The known source and method of preparation—unmistakably indicated on the label—obviated any objection from this angle. Special bottle caps bearing the words, "Reconstructed Milk," or "Reconstructed Cream," revealed the identity of the product as well as the percentages of ingredients.

An equipment capable of handling 2,000 gallons of bottled milk in an eight-hour day, with the opportunity of increasing the output to 3,000 gallons a day by the addition of another pasteurizing and emulsifying unit, was agreed upon as adequate. Milk and cream could be dispensed in either bulk or bottled form, although ample equipment was available for bottling the output. The milk-handling machinery consisted of a buttermilk machine of 300 gallons capacity; a milk pump; two 300-gallon ice-cream batch mixers; two centrifugal emulsors of 200 gallons capacity each, belt-driven from 2-horsepower motors; one tubular milk cooler of 5,000 pounds per hour capacity, composed of two sections, one for water and one for brine; an antifoam tank; a rotary bottle filler and capper; scales and tanks for weighing water, and scales for weighing butter; a porcelain topped table for cutting butter; and a Babcock tester. All of the machinery, except the mixing and pasteurizing vats, emulsors, butter scales, and butter-cutting table, was located on the main floor. The latter machines were on the balcony. The headroom required to insure a gravity system from the mixing vats to the bottle filler was not determined before construction of the building was begun, which fact necessitated the elevation of the mixing vats two feet above the floor of the balcony. They were supported on a stand made of 2-inch pipe, which arrangement should be avoided as it retards the speed of the machinery.

The sundry machines were connected with 1½-inch milk piping, and the valves and fittings were of the sanitary type, easily cleaned. Overhead shafting was obviated, the various machines being operated by individual motors. As originally designed, the engineers did not contemplate the manufacture of ice-cream but the demands for the product were met by the installation of two can freezers, which supplanted a 60-quart continuous brine freezer purchased but not put in operation. These were placed in the balcony, and motor driven. Bottles were washed with an automatic jet washer, cleaning 4,000 bottles an hour. The pumps of the machine were set in motion by a direct-connected 10-horsepower motor. The washer was located in the center of the room and was oriented so

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Stopping Our Coal Leaks

By Charles P. Steinmetz

THE two sources of energy which are so plentiful as to come into consideration in supplying our modern industrial civilization are fuel (including coal, oil and natural gas) and water power.

In 1918, 867,000,000 tons of coal were consumed in the United States. As it is difficult to get a conception of such enormous amounts, I may be allowed to illustrate it. One of the wonders of the world is the Chinese Wall, running across the country for hundreds of miles by means of which China unsuccessfully tried to protect its northern frontier against invasion. Using the coal produced in one year as building material, we could with it build a wall like the Chinese Wall, all around the United States, following the Canadian and Mexican frontier, the Atlantic, Gulf and Pacific Coast, not only hundreds, but thousands of miles, and with the chemical energy contained in the next year's coal production we could lift this entire wall up into space, 200 miles high. Or, with the coal produced in one year used as building material, we could build 400 pyramids larger than the largest in Egypt.

We realize that our present method of using our coal resources is terribly inefficient. We know that in the conversion of the chemical energy of coal into mechanical or electrical energy, we have to pass through heat energy. This involves a transformation from the low grade heat energy to the high grade electrical energy. We get at best 10 to 20 per cent of the chemical energy of the coal as electrical energy; the remaining 80 to 90 per cent we throw away as heat, or, worse still, have to pay for getting rid of it in the condensing water. At the same time we burn many millions of tons of coal to produce heat energy, and by degrading the chemical energy into heat, waste the potential high grade energy which those millions of tons of coal could supply us.

It is an economic crime to burn coal for mere heating without first taking out as much high grade energy, mechanical or electrical, as is economically feasible.

Assume we use 200 million tons of coal per year for power at an average total efficiency of 12 per cent, giving us 24 million kilowatts, and that we use 200 million tons of coal for heating purposes, wasting its potential power.

If then we could utilize the waste heat of the coal used for power generation, even if thereby the average total efficiency were reduced to 10 per cent, we would require only 240 million tons of coal for producing the power; and we would have left a heating equivalent of 216 million tons of coal, or more than required for heating. That is, the coal consumption would be reduced from 400 million to 240 million of tons, a saving of 160 million tons of coal annually.

Or, if from the 200 million tons of coal, which we degrade by burning it for fuel, we could first abstract the available high-grade power, assuming even only 5 per cent efficiency, this would give us 10 million tons, while the production of the 10 million kilowatts now requires 100 million tons of coal. Or putting it the other way, we should have a gain of 9 million kilowatts—12 million horsepower on 24-

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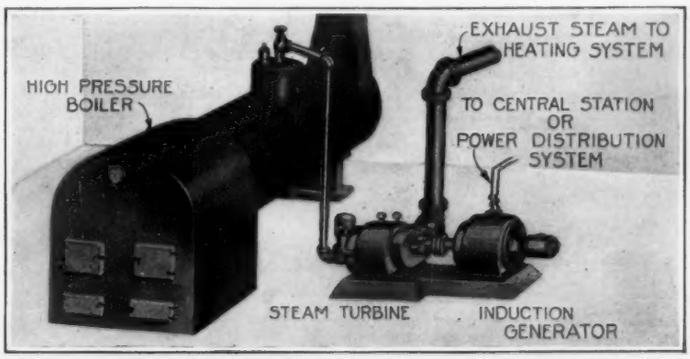
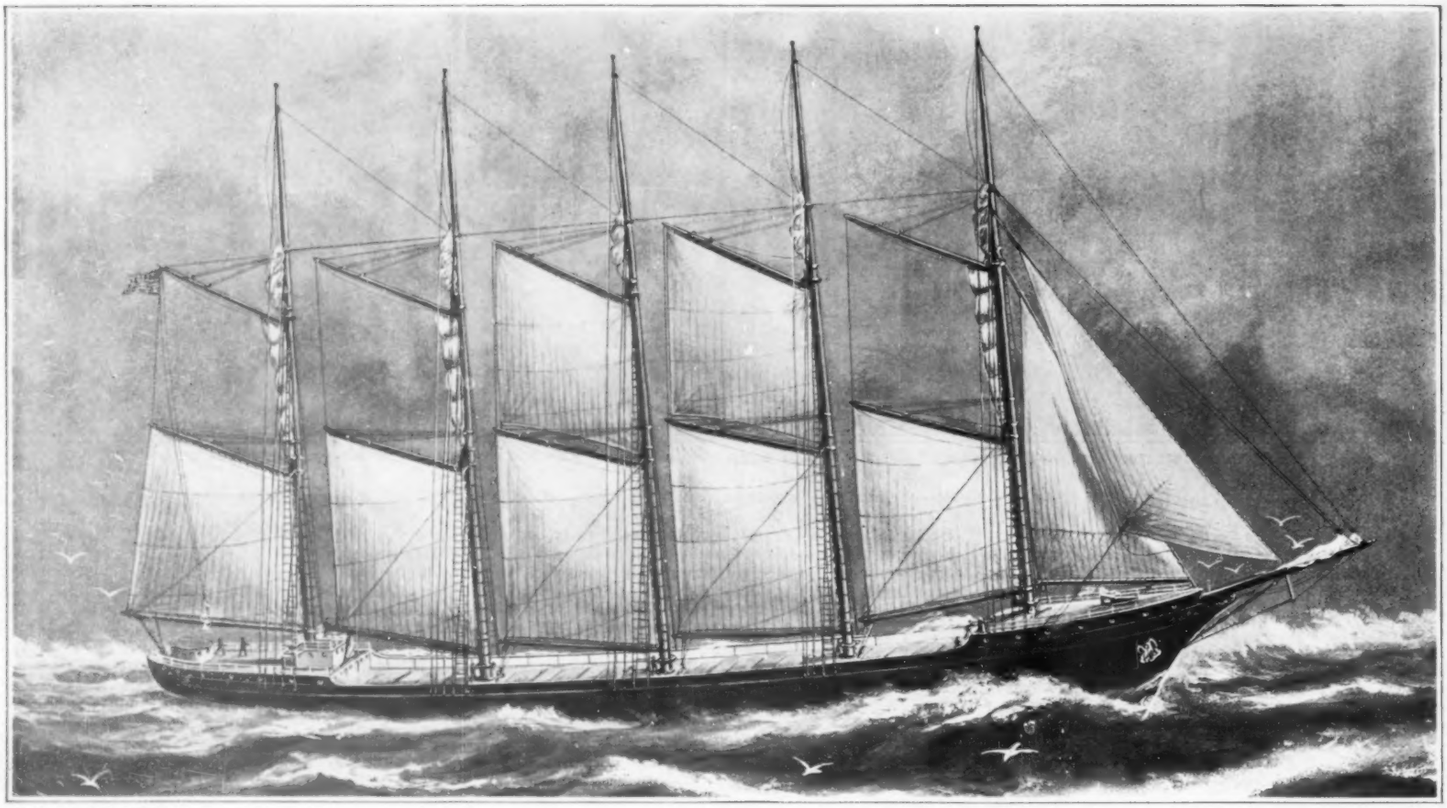


Diagrammatic outline of the apparatus which Dr. Steinmetz suggests for the recovery of power that now goes to waste when we burn coal for heating purposes



The above design for a fore-and-aft schooner was presented at the last meeting of the Institution of Engineers and Shipbuilders in Scotland, as a solution of the present shipping situation in which it is found that, because of high fuel and labor costs, only in rare cases can a steam or oil-driven ship be run at a profit. The design aims at reducing the size of the crew by the use of double gaff sails, and the use of steel wire rope for all running gear led to independent drum, motor-winches operated by switches from the quarter deck. The vessel will be equipped with a single feathering propeller, driven by a Diesel engine, which would also supply light and power throughout the ship

Proposed type of steel auxiliary merchant ship with upper and lower gaff sails

The Sailing Ship's Return

Will the High Costs of Operation Bring In Another Sailing Ship Era?

By John T. Rowland

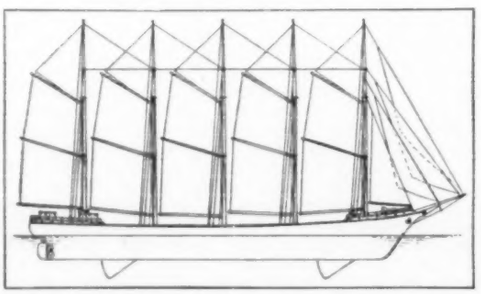
HAS the day of the "windjammer" come back to stay? Practical sailormen have been looking forward to it ever since the war, and now comes a voice from across the Atlantic which asserts positively that such is the case. In a contribution to the *Transactions* of the Engineers and Shipbuilders of Scotland for February, 1921, C. O. Liljegren makes a most interesting case for the return of the sailing ship to its ancient preëminence upon the Seven Seas.

This forward-looking naval architect and yacht designer, who, by the way, served an apprenticeship on this side of the ocean under the great Herreshoff, bases his argument wholly upon the economic features of the situation. In a merciless analysis of the fuel outlook he shows that the cost of operating a machine-driven ship will, in the average case, continue to equal or surpass her earnings for an indefinite period to come.

By the use of a most illuminating series of graphs, one of which we reproduce on this page, Mr. Liljegren endeavors to make it clear that the steamship is not the permanent pillar of commerce that we had come to believe it, but on the contrary that it has owed its predominance to industrial conditions which now are past—never to return. Its recent domination of the seas has been coextensive with the period of cheap fuel, just as the day of the pot hunter was coextensive with the period of abundant wild game.

This will come as a startling idea to many persons. Mechanically driven ships in late years have so completely captured the world's trade that few of us realized by how tenuous a thread their very existence depended, how utterly they are at the mercy of fuel cost. Yet the thing has been demonstrated before.

Fig. 1, *Sauerback's index*, represents the means price of 45 commodities, fuel being among the most important included, for the past one hundred and twenty years. It shows that only when this mean price level was below the line of 82.5 of the index has steam been able to compete on favorable terms with sail in world trade.



Outboard profile, showing full sailplan, the two centerboards, cruiser stern and feathering propeller

Sail reigned supreme up to 1842 although mechanically the steamship was sufficiently developed to give sail a hard run many years earlier. High cost of fuel was the real limiting factor.

During the period between 1842 and 1845 steam was able for the first time to "break even" with sail; then a peak of high fuel cost shut it out again. From about 1848 to 1852 the pendulum swung for the first time positively to the side of steam but the advantage was again pinched out, except for fast freight and passenger service, when prices rose in the troubled period which ushered in wars and hard times on both sides of the Atlantic.

It was only about 1879 that the mechanically-driven vessel came definitely to the fore as the most economical form of ocean carrier. And the graph would indicate that this condition has ended now as abruptly as a lake ends at the foot of a beetling cliff. The fact of the matter is that the mechanical vessel consumes great quantities of an increasingly valuable commodity—fuel. No one would think today of attempting to fire a ship's furnaces on pitch pine: the cost alone would be prohibitive. Ten years from now coal and oil may be in the same class.

Indeed, at the present time the fuel-consuming ship is not able to make a living, and there is little save blind optimism to point to an improvement. When this condition has been in effect for some time one of two things must come to pass: either the world's commerce will cease to be, or a cheaper means of transportation will come into vogue—cheaper, that is, in respect to propulsion even if all other factors remain the same.

"Wind is the one thing that has not changed in price," Mr. Liljegren cogently argues, "and, unlike fuel, does not cost more to give more speed." Why not, then, make use of this immense reservoir

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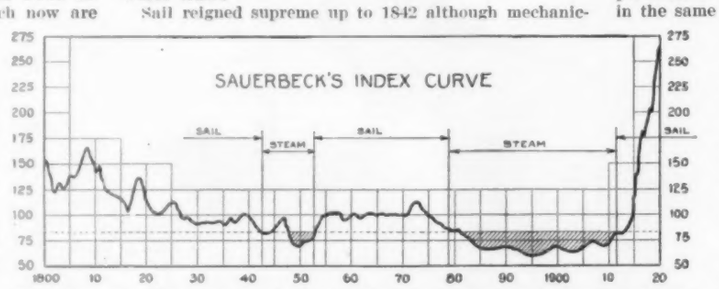


This diagram shows that in the past 120 years, only when the mean price of commodities, including fuel, was below a certain level (82.5 in the diagram) has steam been able to compete on favorable terms with sail in world trade

Bowling On the Green

By William Henry

THE game of Bowling on the Green is a very ancient one, in fact its origin is known to go farther back into the mists of time than the Middle Ages. Shakespeare frequently mentions bowling as in "Love's Labor's Lost," "Taming of the Shrew," "King Richard 2nd," and "Merry Wives of Windsor." In Quarles' "Emblems 1635" is mentioned "The Devil's Bowling Green," a sermon in Bowls.

Bowling on the Green originally was played by using stones which described a curving line when rolled toward a point or jack which in those days was a cone. Some time later the bowls were cut from the inside of a tree, the side toward the heart being heavier caused the bowls to roll in a curve.

The bowls today are made of lignum vitae, a very hard wood, and the curve or bias is given to the bowl by having one side more convex than the other. They are usually 16½ inches in circumference and weigh 3½ pounds. One side has the player's initials engraved on it, while the other, which is the biased side, is numbered, and this side, when playing, is kept on the inside or next the player's body.

Among the early New Yorkers Bowling on the Green was a favorite sport. There was an old Bowling Green at the foot of Murray and Warren Streets on what was known as "King's Farm."

In 1732 Bowling Green at the foot of Broadway was leased at a yearly rental of a pepper-corn by John Chamber, Peter Bayard and Peter Jay, and at that time it was enclosed by a fence and laid out as a Bowling Green.

After the Revolution the game seems to have been ignored, but it was revived in 1879 by Mr. Christian Scheffiin of Dunellen, New Jersey, who started the Dunellen Bowling Green Club. Following New Jersey's example, other clubs were started up until today we find Bowling Green Clubs in a great many cities, such as Brooklyn, Boston, Hartford, Pawtucket, Buffalo, etc., while along the northern New York border and Canada nearly every town has its Bowling Green.

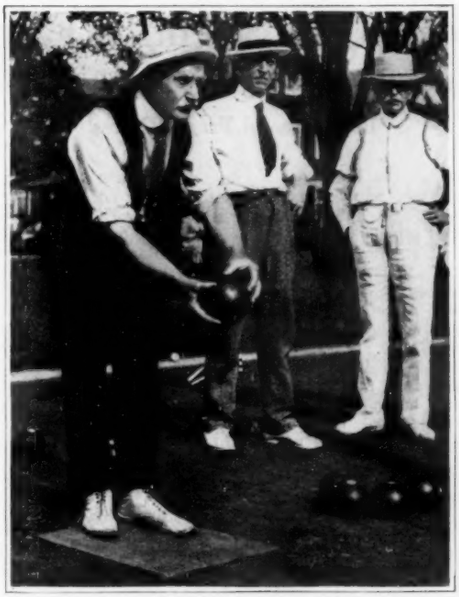
A modern Bowling Green is laid out as a square 120 feet to a side. Two kinds of greens are used: the crown green which slopes each way from the center, and the level green which is the one most popular in this country.

The grass has to be kept cut close and rolled perfectly level, and the players use rubber-soled shoes without heels in order to protect the green. The game is played usually in one direction, and at right angles to that on alternate days. A sloping terrace, or bank, 2 feet high runs all around the green, and a ditch 6 inches deep and 18 inches wide runs inside the terrace.

The green is divided into rinks about 20 feet wide, and a marker is put in the terrace showing the center of each rink.

The game is usually played by two, three or four persons to a side; when single handed or pairs game, each person uses four bowls, but if three or four are on a side only two bowls are necessary to each person.

The jack is a white ball 2½ inches in diameter, which is thrown down the green by the first player, and centered in line with the marker in the bank at the place where it stops rolling. The bowls are rolled toward the jack by one player of each side alternately.



Preparing for a critical bowl

Each team is captained by a skip whose word is law and must be obeyed by the players. The skip is the last one to play, after the three preceding players of his team have sent in their shots guided by his signals. When the skip plays the third player on his side acts as skip. After all the shots are in the bowls are counted to see which side has one or more nearer the jack than the opposing team. This constitutes the finish of an "end" and a game usually consists of 21 ends or less as arranged by the two skips.

Sometimes it is necessary in a close end to use a large pair of calipers in order to decide which bowl is nearest the jack.

Whichever team wins the end is entitled to throw the jack down the green and in this way the length of the rink played varies all during the game.

When the bowls curve on the right side it is called the forehand. When they curve to the left it is backhand. Any bowl which touches the jack is always alive, and is called a toucher.

Science plays a very important part in this game as it is possible to put a bowl in front of, or behind, or even to take away an enemy shot. When tested on a level green, the bowl describes a curve of not less than 3 feet at a distance of 32 yards.

The physical benefit derived from this game is considerable as it calls into exercise the keenest powers of vision, the sensitive touch of the hand, the most careful concentration of the mind, and the beautiful environment of the green with its velvet carpet. All these combined make an ideal sport for any business man.

Cinematography at the Winning-Post

By Dr. Alfred Gradenwitz

IT has long been known that the judge having only his visual impression to guide him is not always able to pronounce a reliable sentence at horse races, and the use of moving-picture records has therefore been suggested. However, because of the high racing speeds (about 15 meters per second), the ordinary cinematograph is of no help in this connection, the average of 18 views per second being insufficient to insure a record of the horse at the very moment his nose is passing through the winning post. Nor can high speed cinematography be resorted to, the apparatus here being too heavy and complicated to be used for this purpose, apart from the impossibility of appreciating the results and enlarging the decisive film sections at a moment's notice.

Following up a suggestion by Captain Stahlknecht, C. P. Goerz, of Berlin, designed an outfit by means of which snapshots with minimal exposures can be taken at right angles to the horses' path, just fixing the moment when the winning horse with the point of his nose is passing through the plane of the winning post. A special camera is placed exactly in the plane, which, after closing an electric circuit, automatically effects a number of successive views with exposures varying between 1/800 and 1/1200 second. One of these is certain to indicate with the utmost accuracy the relative position of the horses at the decisive moment of the race.

Whenever there is a close finish the judge will have a means, before giving out his verdict, of resorting to photography, by causing a plate bearing the inscription "Photography" to be lifted in the place of the number of the winning horse. Experience goes to show that the audience not only willingly submits to this slight delay, but insistently requests the use of photography.

While not being cinematography in the strict sense of the word since it uses plates instead of films, the new method is based on the fundamental principle of cinematography—the photographical fixing of a number of successive phases of movement, following one another at very high speeds.

In order to install on a race course an outfit for the Stahlknecht-Göerz method, the following preliminaries have to be carried out once for all:

(1) Mounting a camera bracket at the judge's stand or at some suitable tower, so that the objectives lie vertically above the winning post line.

(2) Providing an auxiliary finishing line 3 meters before the winning post by connecting a white aiming rod about 3.5 meters high with an aiming wire on the opposite side of the course, where the switch-lever is fixed.

(3) Providing a dark room with all installations required, as close as possible to the judge's stand.

The outfit is a system of five cameras placed above one another, the shutters of which are automatically disengaged in succession, by pressing the key of the switch. Before taking the apparatus into use the objectives should be adjusted to the distance required, depending on the width of the race course; the apparatus must, to this effect, as well as for the sake of ad-

(Continued on page 339)

The five-fold camera used at the Berlin race track to aid the judges in deciding a close race, and a plate showing a triple dead heat which was run on July 1st, 1920

Succeeding in Scientific Farming

A Survey of the Opportunities Awaiting the Man Who Is Going Back to the Land

By Raymond Francis Yates

SCIENCE has invaded every realm of human endeavor and farming has been no exception. Science is showing the way to better, bigger crops, healthier stock and greater efficiency in farm management. The "rule-of-thumb" farmer is gradually becoming educated although he may not appreciate the fact. The gospel of scientific farming, through the good work of our Department of Agriculture, is fast spreading and the farm is becoming more and more like an industry.

The reader can feel that he is indebted to Dr. H. C. Taylor, Chief of the Office of Farm Management, Department of Agriculture, for the information imparted in this article. There is probably no man in the United States better qualified to give advice on this subject than Dr. Taylor, who, before coming to the Department of Agriculture, was head of the Department of Agricultural Economics at the University of Wisconsin.. The author has taken the liberty directly to quote Dr. Taylor in many instances. As the subject is such a difficult one to treat in the allowable space, the author felt that any original views he had on the subject would have to be subordinated to those of a man who knew a great deal more about the field.

When Dr. Taylor was asked what education he considered necessary to succeed in scientific farming he answered that, "a so-called 'higher' academic education is desirable but not essential. There are great numbers of farmers who conduct their farms on a scientific basis, but who have not had the advantage of more than a common school education. On the other hand, there are those who have completed courses in agricultural colleges but have not been able to make a success of farming. In general it may be said that education neither creates nor destroys a good farmer. The tendency is for education to improve both classes. The essential thing is that the farmer understand the forces with which he has to deal and possess the wisdom to adjust his actions to his conditions. Other things being equal, the college man will not only do better in this regard, but make a more helpful citizen."

The mention of education suggests the question of whether or not a man can succeed in scientific farming without attending college. Anyone contemplating entering this field who cannot see the way clear to attending school may be encouraged by the fact that only a small percentage of the successful farmers in this country are college trained. It is a mooted question whether or not these men would have been more successful had they possessed the advantage of a thorough college training. It is possible that the greater part of them would have attained more success if they had a thorough training such as that offered by a few of the leading colleges of this country today.

Statistics show that the percentage of college trained farmers is rapidly increasing. There is probably greater opportunity for success for the self-trained man in this field than in any other. Any wide-awake, alert young man with plenty of ambition and with a yearning for the invigorating outdoor life of the farm can succeed without attending college. The garnering of the necessary knowledge for success cannot be accomplished in a year or in two or three years without practical experience.

Farming is one thing that cannot be successfully taught by a correspondence school course or any amount of reading without the advantage of practical experience. The young man desiring to succeed in this field should first get on a farm, whether it is his own or not, and then study should be started. In following out a course of this kind one should remember that the Department of Agriculture can be depended upon for information along most any line of farming. This department is devoted to research work and to the dissemination of information to the farmers of this country.

The demand for men trained in scientific agriculture is increasing every year. This demand is by no means confined to the operation of farms. It comes from State and Federal departments, agricultural colleges and universities, as well as from commercial firms that have to do with farm products.

When he was asked what he believed to be the necessary qualifications for a young man entering the field of scientific farming, Dr. Taylor answered: "The first qualification for scientific farming is farm training. It is desirable, although perhaps not altogether necessary, that one who goes into farming should have been reared upon a farm or at least should have spent considerable time working upon one. Other qualifications are, reasonably good health, business ability which involves sound judgment, a realization of one's limitation and the love for country life. In general it may be said that the successful operation of a farm requires all those qualifications which make for a successful career in any other business or profession, with the one exception—that farming requires a closer application of those qualifications and gives greater freedom of action."

To one about to enter the scientific agricultural field the question of the length of time needed for training is an important one. Dr. Taylor answers it in this way: "As I have attempted to explain, a man may be a scientific farmer without having gained a knowledge of his scientific methods through academic training. On the whole, however, the academic method is the quicker way of gaining this scientific knowledge. A four-year course at a good agricultural college is desirable. If it is not possible to obtain this, a two-year course may answer the purpose, although it will not take the place of the longer period of training where the work involved is highly technical. It is often necessary for the one intending to take up a highly technical line of work to spend from one to three years in a graduate school."

BECAUSE of the present slackening up in industrial activities throughout this land of ours, it is altogether natural that we should have a powerful revival of the back-to-the-land movement. For it is a fact that this movement comes and goes just like the tides of the ocean; in boom times, when the factories and mills and business houses are at the peak of activity, there is a steady flow of population from the countryside to the cities. But with the advent of slack times and the laying off of factory and mill and business workers, there is a gradual counter-flow or back-to-the-land movement. So it is a most opportune moment to present in this instalment of our "Success" series, a survey of the opportunities in scientific farming.. Mr. Yates tells us many interesting things about present-day farming, and we certainly believe he has made out a strong case for the man who is going back to the land.—THE EDITOR.

The chap who cannot attend college should just keep on "plugging" until he feels that he has succeeded. Ability varies so in different individuals, as well as the capacity for learning, that it would be difficult to say just how long it would take a man to become a successful scientific farmer outside of college. Much would also depend upon whether he had had previous experience in farming. A man who had been brought up on a farm would have a tremendous advantage over a man brought up in the city although the city man does not present a hopeless case by any means.

Do a great number of scientific farmers go into business for themselves? Dr. Taylor's answer to this important question follows: "Yes; although the demand for those trained in scientific agriculture by State and Federal institutions, agricultural colleges and universities, has been so great that the farm has not taken as many of these men as it is likely to take in the future. It is to be expected that as the agricultural colleges turn out more graduates, a greater percentage of them will return directly to the farm. On the other hand, it must be explained that one of the reasons why graduates of agricultural colleges turn to salaried positions, rather than going to the farm, is the fact that it requires considerable capital to actively engage in farming."

It is difficult to say just what the salary of a thoroughly experienced man in scientific agriculture can be. It is one of those questions that can be answered largely by "it all depends." In scientific farming it is "determined by the amount some millionaire, farming by proxy, is willing to pay in order to get just the man he wants to run his farm." Of course, with salaries there must be considered the question of living expenses which are generally included. In general it may be said that there are few high salaried positions to be had in this field. On the other hand there is no definite limit to the amount that may be earned by a man in business for himself. This will be determined by the amount of land he has available and the nature of his crops.

There is always need for specialists in every branch of scientific farming. A man may specialize in the raising and care of various kinds of stock, or he may specialize in wheat, corn or fruit.

Dr. Taylor was asked what he thought of the college courses being offered in scientific farming. He said that he did not believe they were perfect any more than he believed that the college courses in any given field were perfect. The courses are better now than they have been in the past and they seem to be continually improving.

What should the ambition of every scientific farmer be? Dr. Taylor answered this inspiringly when he said: "To obtain a greater grasp and a more complete knowledge of his profession, to apply this knowledge to his own environment in such a manner as will make farming more profitable, and to become a leader in the establishing of better living conditions in the country."

Any farmer who uses the forces at his command—land, labor, capital and managerial ability—with a moderate degree of efficiency, is a benefactor to mankind. A scientific farmer is only scientific to the degree in which he makes efficient use of the above forces. This being the case, it would necessarily follow that a scientific farmer is a greater benefactor to mankind than is the farmer who does not employ scientific methods.

The following information taken from a bulletin issued by the U. S. Department of Agriculture will be of interest to those who are contemplating a farming career.

Agriculture is the greatest single line of industry in the nation. Since 1916 the value of its annual output has exceeded $20,000,000,000 while in 1919 the estimated value of crops, and of live stock and animal products totaled nearly $25,000,000,000, which is about the equivalent of our entire national debt. These figures, of course, do not represent net value, because much of the crop production is fed and marketed in the form of live stock, nor do they represent the net return of profit to the farmers, but merely the gross farm output.

The value of farm buildings and equipment was reported in the 1910 census as $40,991,000,000. With the rise in value since the last census, and on basis of present prices, the value of farm property is now probably in excess of $80,000,000,000, five times the value of all the railroads in 1910, nearly 20 times the value of the iron and steel industry, nearly 40 times the value of the textile industry, and forty times the combined value of more than 75 distinct groups of miscellaneous industries. Except for the railroads, the value of live stock alone on farms on January 1, 1920, was several times greater than the capital valuation of any other single industry in the United States.

The 1910 census also shows that approximately 12,300,00 persons—the farmer himself and his hired help—were then employed in agriculture, 20 per cent more than in all manufacturing and mechanical industries combined; 372 per cent more than in transportation, 242 per cent more than all the bankers, merchants, wholesalers, jobbers and retailers; and 1281 per cent more than the number engaged in the extraction of minerals. It is estimated that at the present time there are approximately 7,000,000 farmers in the United States and that the number of adult male farmers and hired farm helpers is probably about 14,000,000. More people are engaged in farming, and are directly or indirectly dependent upon farming for a living than any other single industry in the country.

These facts emphasize the fundamental importance of agriculture. Unless agriculture prospers, other industries cannot hope to prosper—and agriculture cannot prosper unless the individual farm business is profitable.

The Train Director and His Work

How Hundreds of Trains Are Handled In and Out of a Giant Railroad Terminal

KEEPING the terminals clear so as to take care of incoming and outgoing trains is the main operating problem of a railroad. For with a four-track main line and an efficient system of automatic signals that permits of reducing the headway to a minimum, there is practically no limit to the amount of train traffic that can be handled, if the terminals are ready to receive that traffic.

How hundreds of trains in and out of a large terminal are handled without hitch or mishap inspired the cover illustration of this issue. In the Grand Central Terminal, in the heart of New York City, something like six hundred passenger trains are handled daily. Made up into a single train, this traffic would represent a train forty-eight miles long. These trains must be assigned to the proper tracks in the terminal with all the switching and signaling that such operations involve. And if the long obsolete practice of using stand switches with individual switchmen were still in vogue, it would require many hundred men continually on duty to operate these stands; furthermore, beyond the layman's possible reasoning, it would also require a corps of men to direct the switch tenders and the trains so that they might be run over the tracks and through the switches with safety and dispatch. The present method of operating the switches and crossovers and signals from a central point, known as an interlocking station, has enabled all these operations over an extensive area to be controlled by a small number of men headed by a "director," as shown in our cover illustration.

Still further to safeguard and facilitate train movements, a device known as a signal is placed at specified locations by which information is given to the men driving the trains as to the direction they will take and whether it is safe to proceed beyond the signal. In other words, the means used to operate the switches and signals jointly take the place of a man, were he located at the switch and operated the switch with a switch stand.

The operation of the switches and signals is under the supervision of the "director" as already stated, and the actuating of the various devices is made possible by the use of an electric motor. The motor of each switch and signal is connected by wires to levers assembled in a machine termed an interlocking machine. The motors are run by current supplied by storage battery—a positive source of power. The levers are pulled by men called "levermen," who work under the instructions of the "director."

The interlocking stations of the Grand Central terminal are buildings or houses where the interlocking machine is located to protect it from the elements. The interlocking machine comprises a large number of cabinets which mount several batteries of levers, the manipulation of which operate certain signals and switches. The mechanism of the interlocking machine is such that it is mechanically impossible to operate any lever except as arranged, otherwise collisions by the giving of wrong signals might result. The checking or locking of levers is accomplished by moving slides attached to the pistol-grip-like levers used to open and close the circuits that operate the motors for the switches and signals.

Now all trains reach the Grand Central terminal over the four tracks located under Park Avenue—those from the Hudson River towns, the West, Canada and the Adirondacks joining those from the Bronx, Berkshires, and New England at 149th Street in Park Avenue, or five miles north of the station proper, at a point known as the Mott Haven junction.

The dispatching or handling of trains through the medium of interlocking devices by "directors" and levermen is very simple. Since the construction and location of the large interlocking stations make it possible only to see the trains arriving and departing from the main yard connections, the "director" assumes the rôle of a general manager of trains and interlocking movements, sitting at a desk to which are fastened animated diagrams showing the complete track layout over which he has supervision, as well as showing, by means of tiny electric lamps, which sections are occupied and which are vacant. The levermen who operate the interlocking machine also have positive information as to the position of switches and signals by means of tiny light indicators.

A train for the terminal from Chicago or any other point is announced to the "director" at the Grand Central station by the "director" at the Mott Haven junction, five miles distant. The announcement is made by means of a special annunciator, shown to the left of the "director" in our cover illustration. This annunciator, by means of small electric lights, indicates the kind of train coming through, and on what track, in order that the "director" at the terminal can prepare to receive it. It must be remembered that as many as a dozen trains are moving at the same time in the same or perchance different directions.

By pushing a button at his end the terminal "director" can reset the annunciator at the Mott Haven "director's" post, thus indicating that he is prepared to take care of the train. The "director" calls out to the levermen the various orders for setting switches and signals, and watches the progress of the incoming and outgoing trains on the animated track layout plan in front of him. The levermen, too, know when the way is clear, for they have small indicator lights for each lever. The reverse operation is followed for outgoing trains.

All in all, the trains are guided to and from the terminal with clocklike precision under the control of the "directors" working at their pushbuttons and kept in touch with train movements by means of animated track layout diagrams.

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

The Irish Monorail

To the Editor of the SCIENTIFIC AMERICAN:

Referring to your issue of Nov. 20, 1920, I would say that the "curious little monorail road in Ireland," described on page 515, does not run from Killarney to Ballybunnion (not Bally Bunion). It runs from Listowel to Ballybunnion, a distance of 9 miles. Killarney is some 40 miles by rail to the south of Listowel. This curious little railway is, I have understood, the conception of a Frenchman. HALDEMAN O'CONNOR.

Harrisburg, Pa.

A Question of Biology

To the Editor of the SCIENTIFIC AMERICAN:

As I am on a houseboat trip in the beautiful Fu River Valley in interior Kiangsi, I have a little leisure to look over the 1920 file of your valuable paper, which I have with me.

In your number of April 10, 1920, Dr. Conant discusses at some length an article in the Nov. 15, 1919, issue on the question of the death of metazoa and the immortality of protozoa. There seems to be a little confusion of terms taken for granted, and this interferes a bit with the very beginning of the argument. This confusion is betrayed in the very statement of the question.

The confusion arises from the fact that the protozoan combines in a single cell all the functions of its life, while the metazoan shows a division of parts and a separation, more or less complete, of the vital functions. Thus we find that in discussing metazoan life we can distinguish clearly between individual life and racial life. The metazoan has certain cells set apart expressly for the purpose of prolonging racial existence and these cells are, as it were, fed and protected by the rest of the cells of the body. In the protozoan the reproductive function, the feeding function, the protecting function, and all the other functions are carried on in the one cell.

From the standpoint of individual life it makes little difference whether we are considering a protozoan or a metazoan, provided we make the distinction outlined above. The individual can cease its existence by accident (disease, old age, weakness preyed upon by slight and obscure diseases or accident, or physical violence such as is done by chemical or mechanical means), and in metazoa this is practically the only method of bringing life to an end. Death from pure old age seems to be largely a fiction, since, while we can imagine it easily enough it is hard to find a scientifically pure example.

In protozoa the individual may cease its individual existence by fission, that is, divison into two new and separate individuals, or by conjugation, which is union with another individual's reproductive elements, and is immediately followed by fission. Whether the individual ceases its separate existence on conjugation or not, it does immediately afterward in fission, so the question is a bit academic.

The protozoan racial life is prolonged by the fission and conjugation-fission processes, while the metazoan racial life is prolonged by the reproductive act, which is essentially the same as the protozoan conjugation, that is, the union of two cells—at any rate the union of selected parts of two cells, followed by division and leading to the production of a brand-new individual.

A race of protozoans kept from conjugation becomes subject to certain changes which show themselves in the production of freaks and weakened individuals, and the whole colony suffers a process of degradation to the condition familiar in metazoans as old age. Conjugation seems to bring about a rejuvenation and immediately makes possible a new and perfect race with youth and strength.

In this way it is possible to have under experimental conditions a real separation of the protozoan life into (1) individual and (2) racial life, and when this is done it is easily seen that there is no essential difference between the lease held on life by protozoans and metazoans.

In either case the individual comes to its end by disease, which is a form of accident, or by violence of some kind, which is also accident, and occasionally the individual lives so long that in the weakening due to old age it is hard, perhaps impossible, to pick out the particular violence causing the death, and theoretically at least it might be possible to have death due to the weakening of old age alone.

In either case, too, the racial life is, so far as we know, eternal, with the exception that a particular branch of the race may suffer extinction by accident, in the metazoan by the death of the individual before the reproductive process results in the formation of a new individual, and in the protozoan by the same thing, which reduces in expression to the death of the individual at any stage in its existence, since it is potentially able to reproduce at any age.

Dr. Conant has left the question I have been discussing and proceeds with a discussion of ultimate forces. I have nothing to say about the remainder of his discussion, and am seeking merely to outline what I conceive to be the correct parallel between protozoan and metazoan life and death. FRED R. BROWN.

Nanchang, China.

Plane vs. Bird

To the Editor of the SCIENTIFIC AMERICAN:

Although mechanical flight has been perfected to a degree where its practicability can no longer be doubted, it cannot be stated that the principles governing airplane flight and bird flight are the same. In propelling the airplane—in pushing or pulling this heavier-than-air machine forward by rapidly rotating propellers, man is utilizing the air resistance force in an entirely different manner than the bird. The forces brought into play by the flying bird are, first, gravitation; second, air resistance; third, the muscular energy of the bird. The first produces the motion of the bird in air, the second furnishes the medium whereby the direction of motion is altered and the third controls the direction. In attributing the motion of the bird in air to its weight as the force of gravity thereby represented it should be remembered that this motion does not differ from the falling motion of any other heavier-than-air body. The wingless body of a bird unsupported in mid-air is in a state of motion for the same reason the winged bird moves in this medium; the winged bird alters the direction of motion by utilizing the air resistance against these surfaces does not however create motion itself. The airplane gliding from a height with propellers stopped changes the direction of a falling motion; to say that the bird propels itself forward by its wings is equal to saying the supporting surfaces propel the gliding airplane. The bird converts the descending glide of the rigidly constructed airplane into a prolonged glide it increases the air resistance to a degree equal to its weight by beating its wings, establishing thereby a horizontal gliding motion. The cause of its motion however remains identical with that of the gliding airplane. A. HUTH.

New York.

Hydroelectric Power in Argentina

Will the Iguazu Falls Provide the Solution of a Grave Fuel Problem?

By Leonard Matters

WHEN Mother Nature destined the vast territory known as Argentina to be one of the greatest agricultural countries in the world, she showered her favors upon the land, giving it a climate that is like one eternal spring, and so enriching the soil that not yet, after a century of close cultivation in the older farming areas, has it been found necessary to restore fertility by the use of artificial manures.

But having done all this, Nature stopped short, considering (one might suppose) that she had done enough, and deciding that if the Argentines wished to develop secondary and manufacturing industries they must not count upon her. Not a ton of iron; not a ton of coal, did she bestow—or if she did then her bounty has not so far been discovered anywhere in the republic within range of the big cities. There is coal and there is iron, but it might just as well not exist as be where it is—hundreds of miles beyond economical working and transportation.

Nevertheless, the Argentines, who are born optimists and a most ambitious people, are determined that manufacturing industries shall be developed. Iron and other metals they can import. The problem is one of power. Coal costs just now about fifty dollars gold a ton, and every ton must be imported. At that price, and with no guarantee of regular or sufficient supplies from countries where calamitous strikes are always liable to occur, coal cannot be looked to as a factor in manufacturing. The oil fields of Comodoro Rivadavia cannot yet supply more than a fraction of the liquid fuel the country consumes, and until a railway is built Comodoro Rivadavia will always be five days by steamship from Buenos Aires. In the last five years the shortage of coal has been made good by burning quebracho wood, and feeding scores of thousands of tons of maize into furnaces. This cannot go on. The near-by forests have been cut out, and the wood cutters are daily retreating farther and farther inland, making the cost of wood higher and higher until even now the price is not far below that of imported coal. Argentina's dreams of a great manufacturing future may be entirely unwarranted when we think of the superior advantages which the United States and Europe possess, and which enable them to produce what the republic needs for less than those needs could ever be supplied by artificially created industries in Argentina; but the Argentine will not admit it. His optimism and ambition tell him he can become a manufacturer if—and this is the only problem he will agree exists—he can solve the problem of power production.

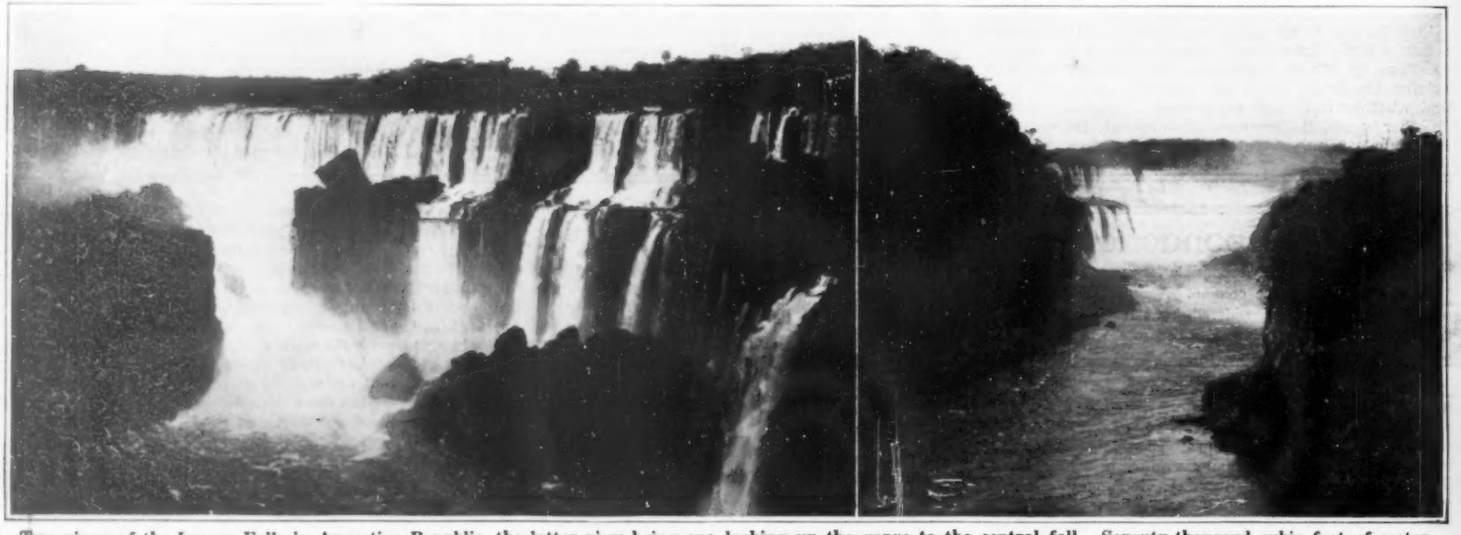
That is why, in the last five years or so, so much has been heard of the project for utilizing the immense waterways of the republic to generate electric power. That is why the name of the Iguazu has been advertised abroad, and the falls to which the name applies have in a sense been discovered to the world. And they are falls worth the world's notice if for no other reason that they have only two rivals—Niagara and the Victoria Falls on the Zambesi.

When Nature came to her decision about Argentina's future she evidently forgot that in creating the Iguazu she was providing the means whereby something more than an agricultural destiny might be realized. Possibly she did not forget it. Possibly she was well aware of the potentialities of such a physical phenomenon in the land, and merely desired that if the Argentines would determine to become manufacturers, then in the Iguazu lay the problem for solution. And a tough problem it is, though quite airily spoken of. To make use of the falls is going to be one of the biggest engineering jobs of the future, and a future that is perhaps a very distant one.

Up in the hinterland of South America, where the frontiers of Argentina, Brazil and Paraguay run together, is the Iguazu River. The Brazilians spell it "Iguassu." The Argentines spell it "Iguasu," or "Yguasu." This river discharges into the Upper Parana, the Parana being a mighty waterway, flowing in its turn into the Rio de la Plata, and constituting a navigable stream, hundreds of miles long, up which ocean-going vessels proceed for a considerable distance. The Parana is the Mississippi of Argentina and Paraguay. At a point 750 miles from Buenos Aires are the Iguazu Falls. They could hardly be more inaccessible than they are, unless they were up in the heart of the Amazon forests, which accounts for the fact that not one in ten thousand Argentines has ever seen them; and though tours to the falls are advertised in Buenos Aires only a few persons visit them every year. To get to the falls requires a long railway journey, or the slower voyage up the Parana. In either case the trip calls for a second stage by small river steamer, to within about 20 miles of the Iguazu, and a final stage by mule cart, or more recently by automobile. But those who have been there declare the sight to be worth all the trouble—a greater spectacle than Niagara itself.

The river flows deep and swift. Twenty miles above its mouth its width lessens, and the waters are compressed. The river takes a sharp turn round a horseshoe shaped course, and rushing through numerous islands which bar its way, and spread its waters, it plunges sheer down a precipice 230 feet deep. Once over the falls the water is again compressed in a narrow gorge through which the torrent roars and boils on its way to calmer reaches of the Upper Parana. It is estimated that in the wet season the volume of water pouring over the falls is equal to 70,000 cubic feet per second. The Iguazu is not fed by mountain streams, carrying off melting snows. It is a huge drain for a belt of country in which heavy sub-tropical rains fall. The maximum flow is in the rainy season, and the minimum in the dry period when the volume of water passing the falls becomes reduced to no more than 7,000 cubic feet per second.

Here then is a tremendous force that engineers would like to harness and utilize. If the Iguazu were in Europe or the United States, or even if it were still in Argentina, but closer to the settled areas, it would have been put to effective use long ago. The power is there, but a double problem presents itself when consideration of how that power is to be taken advantage of is entered upon. Can this power be transmitted to where it can be used? This question electrical experts alone can answer. If it can be transmitted, is the cost of the undertaking going to leave any profit? In other words, will the cost of the power, when it is brought where it is needed, be too great to permit of its use in place of the power now generated from imported fuel? This double-sided problem is just now exercising the minds of the experts of the Argentine Government. Schemes for developing hydroelectric power at the Iguazu Falls are always being discussed in Buenos Aires. So far as the author can ascertain a thorough investigation of the proposition has never been made by any capable hydroelectric engineer. Such experts are hardly to be found in Argentina for the simple reason that up to the moment there has been very little demand for their services. Water power for generating electrical energy is something that has scarcely been studied in the republic, and the plants already established could be numbered on the fingers of one hand.



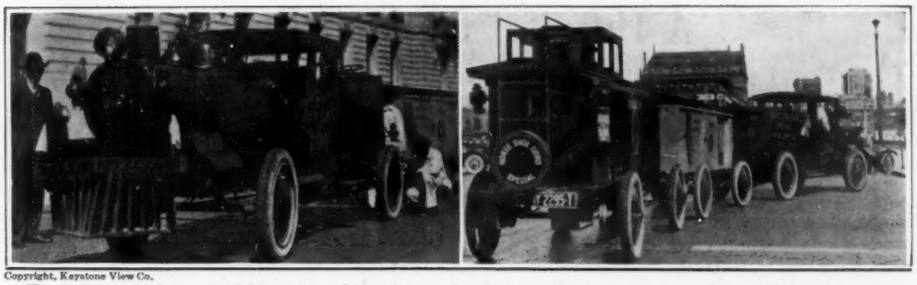
Two views of the Iguazu Falls in Argentine Republic, the latter view being one looking up the gorge to the central fall. Seventy thousand cubic feet of water are now running to waste every second

It is claimed, however, that Argentine Government engineers have now conducted a careful investigation of the Iguazu proposition, and the announcement that their report will be published shortly has inspired this article. In a summary of what will appear in this report, which has been printed in the Buenos Aires newspapers, the Government engineers are credited with the statement that in its technical aspects the scheme for utilizing the power of the falls is feasible, though they will not commit themselves on its economic possibilities. The normal energy to be generated under the scheme investigated by the engineers is given as 125,000 kilowatts, derived from a battery of turbines of the "Francis" type, developing 23,000 horsepower. There would be twelve of these turbines constantly at work, with two more in reserve. For ten months of the year the normal supply of 125,000 kilowatts could be relied on, but to insure its constancy for the full year a dam would have to be constructed across the river above the falls. In their report the engineers deal also with a subsidiary power station on the River Uruguay at a place called Salto Grande where the rapids would give a head of water of about 75 feet, and another 50,000 kilowatts could be generated. The cost of the entire scheme is estimated to be between $60,000,000 and $70,000,000 gold.

(*Continued on page 340*)

A Make-Believe Freight Train for Publicity Purposes

BY dressing up a light automobile and two trailers to represent a steam locomotive and two freight cars, a Western pneumatic tire manufacturer has obtained the superlative degree of publicity—if there be such a thing. At any rate, his make-believe train has been operating over California highways, hauling many loads of tires and attracting wide attention wherever it has chanced to pass. The trailers are of the tracking type; that is to say, the trailer wheels will track behind the wheels of the tractor, so that even the sharpest street corners can be turned without difficulty and the train can make its way through the densest traffic without difficulty. Chime bells, operated by electricity and played by a lady musician stationed in the caboose serve to draw the attention of motorists and pedestrians alike.



Copyright, Keystone View Co.

Two views of the make-believe freight train employed by a tire manufacturer for publicity purposes

Motor Laws at a Glance

THE State of Connecticut has decided to make its motor laws quite plain to everyone having opportunity to use its roads. To this end there have been erected at various important points large painted billboards of the kind shown in the accompanying illustration, stating in detail what the motor laws of the State mean when translated into plain English.

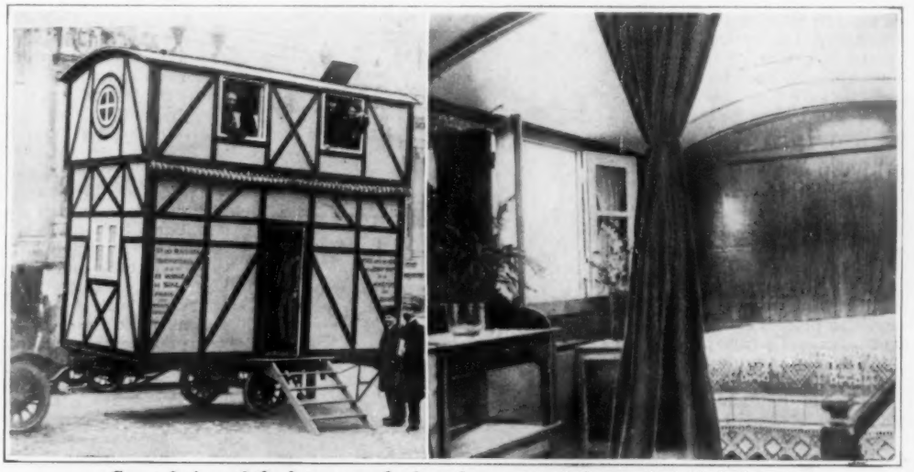
Copyright, Publishers Photo Service

When confronted by such signs as this the motorist can hardly plead ignorance of the motor laws

A Home That Goes Anywhere

PARISIANS were startled recently when they saw a small, two-story house on wheels being hauled through the city streets by a motor car. And they were still more startled when the inventor invited them to inspect the interior, thus revealing a surprisingly large range of accommodations for so small a domicile.

The house mounted on wheels while being transported, consists of four rooms, including kitchen, heating equipment, miniature staircase and modern conveniences. The house is eight feet wide and fifteen feet high, but by means of telescoping walls it can be brought down to 9½ feet in height to facilitate transportation. The French Government has ordered a considerable number of these portable houses for the inhabitants of the devastated regions, inasmuch as they are being turned out for $835 complete.



General view of the house on wheels and a corner of the comfortable bed room

Storing Gravel a Different Way

LACK of storage space in building an industrial plant in an Eastern city recently resulted in a novel method of storing gravel. It was necessary to maintain a high pile of gravel because of the unreliability of delivery by truck and because of the high cost of wheelbarrowing.

A wooden bin with a gate and chute in the lower end was constructed in front of the mixer hopper. When the mixer hopper was being elevated to discharge into the mixer the chute to the bin was raised out of the way as it was hinged to the gate. A plank incline was built from the front down to the pile of gravel. A snatch block was fastened overhead to the frame of the concreting tower. A cable through the block and through one lower down on the tower was passed over a drum of the hoisting engine. The other end of the cable was fastened to an ordinary drag scraper on the gravel pile.

Spreading out in the shape of a fan to the street from the inclined planks, the gravel was dumped from the delivering trucks. The scraper was guided into the pile and the hoisting engine pulled it up the incline where it was dumped into the bin. From the bin the rock was taken out as required in mixing operations.

By means of an ordinary drag scraper the gravel is scooped up to the bin

Two Ways to Test "Oil"

TRAMPING through the woods, the close observer sometimes notices a film-like covering on water, particularly stagnant water, which looks as though it might be oil. Oil is a fantastic topic nowadays, subject as it is to spectacular discovery, bringing great wealth, and these blinish films on pools naturally often suggest the thought that petroleum is near. There are simple tests—even a boy can make them—which will enable the curious one to get at the root of the matter.

In swampy spots bacterial scums are common. Sometimes they are strongly suggestive of oil. To determine whether a scum is bacterial or oil, take a stick and gently break the scum apart. Now watch its behavior. The bacterial scum will break up into patches. If there is movement to the water, it will float away. It will not join again. Oil scum, on the other hand, if gently stirred or broken, will spread, then come together. This test is vouched for by geologists as excellent.

If the scum comes together, the next test is to gather up some, enough for a drop, and let it fall on a hot stove cover. The smell of the substance in contact with the hot cover is a further test. If it's petroleum it will smell of it.

All that looks like oil is not oil. The oil-like film noticed on the still, swampy pool is probably just a bacterial scum. But one can put the matter to a test, and know for sure.

A Hospital for Mail Bags

How the U. S. Post Office Department Operates a Factory for Making and Repairing Mail Bags

By S. R. Winters

UNCLE SAM, the administrator, diplomat, guardian of the Treasury, and numerous other titles befitting the dignity of his position, assumes a comparatively new rôle—that of a manufacturer. His specialty is the production of mail bags. The government-owned building, a steel and concrete manufacturing establishment representing an original investment of $200,000, is situated on the corner of Fifth and W Streets, Northeast, Washington, D. C., and in structural design is a model for the purpose. Approximately 200 men and women are employed in making and repairing mail sacks, and not unlike other busy manufacturers engaged in quantity production, employees of Uncle Sam work two shifts of eight hours each.

Prior to 1918 the containers used in hauling letters and parcel post from coast to coast, as well as to and from thousands of intermediary points, were manufactured by commercial concerns. Awards were made to the lowest bidder. During 1919 the Federal Government, securely entrenched in its new manufacturing establishment, made 472,350 sacks within the specified time, at a saving, according to claims of the United States Postoffice Department, of $53,530.22 under the lowest bid received from commercial enterprises. For the corresponding period of time, 2,532,632 bags were repaired in the salvage department of the mail equipment shops, at a trifling cost of 7.4 cents apiece. Cord fasteners, grommets, and other metal attachments are supplied in this government workshop, the cord used in closing bags and pouches entailing the consumption of 70 carloads of twine during the past fiscal year. Supplementary to meeting its own requirements, the mail equipment shops manufactured 10,368 pieces of equipment and attachments for other government departments and the postal service of the Philippine Islands.

A light weight canvas has been recently adopted for making sacks, the change from heavy quality resulting in an economy of $174,769.50 in a year, it is estimated. Number 8, 32-inch duck cloth, is used for making standard number one domestic mail bags, the Post Office Department buying the material from manufacturers in rolls varying from 200 to 500 yards. These immense bolts of cloth are placed on a rack five rolls at a time and unrolled by hand on to a table, the five thicknesses being cut at one time into the proper length. Ninety-three and one-half inches of cloth are required to make a domestic mail sack. The canvas, having been cut into mail-bag proportions, is conveyed to the stenciling department, where Uncle Sam puts his imprint, "Domestic, U. S. Mail (1)." The label makes it unmistakable that it is not a spurious product and by the numbering process differentiates between different kinds of sacks and pouches. One operator can stencil 1,200 bags in an 8-hour day.

When the writer visited the mail equipment shops a machine, designed by F. A. Lazenby, of Baltimore, was being installed for the specific purpose of displacing hand labor with machinery in stenciling mail sacks. The apparatus, the first of its kind to be built and for the special use of the Post Office Department, is supposed to cut, fold, and stack the canvas for the bags. If practical application justifies the claims of its inventor, the mechanism will displace the services of eight men. A mechanic and helper operate the machine. The canvas is fed from a large roll supported on a rack, the cloth passing under a revolving drum bearing printing dies containing the desired wording. The drum is equipped with brass strips which regulate the cut to any specified length. Following this is an automatic knife which is operated by cam action, from which it feeds out over a moving table which consists of two short conveyors. The canvas is fed out on these conveyors until the bag is centered over a folding blade which automatically rises. This operation starts a center fold of the canvas through two rolls which changes the course of the bag on to an incline belt conveyor which makes delivery to a stacking cradle. The machine extends over a distance of 20 feet, and weighs about 8,000 pounds.

Whether cut, folded, and stacked by hand or machinery, the succeeding process in the manufacturing of containers—serving alike the transmission of the letters of the lovelorn maid and the stern business man— is the distribution of the canvas to union special sewing machines. These units, operating at a rapid speed under the manipulation of women, first apply the seams to both sides of the sack at a single operation. Each woman operator is capable of completing the seaming process of 300 mail sacks in eight hours, with 350 bags being the creditable performance of unusual speed. A quick transition is that of transferring the bags from the seamer to the hemmer, the two machines being located on the same table. Each operator inserts the hems in from 400 to 500 containers in an 8-hour day.

Stated in accordance with the logical sequence of things, the grommeting process is then recognized; that is, eyelets are placed in the sacks. Thirteen metal grommets are so spaced in the hem of the bag as to facilitate its suspension in any standard rack of the postal service, taking for granted that the container will be subject to innumerable vicissitudes in a devious journey, mayhap, across the continent. The insertion of the grommets is accomplished, first, by the use of a wired punch press which penetrates at one time all the holes necessary for the installation of grommets. As many as 4,000 sacks can be punched by an expert operator, working eight hours. The process of placing the eyelets is completed by inserting the metal grommet (which consists of a flanged tube and a ring) in the hole perforated in the sack, using a small punch press operated by boys ranging from 16 to 21 years of age. Each boy, working for a minimum wage of $2.88 for an 8-hour day, is capable of inserting grommets in from 300 to 550 bags.

Once grommeted, the mail containers are equipped with lacing cord and cord fasteners. The work is negotiated by women, one of whom labors daily at the job in spite of having the misfortune of being bereft of eyesight. Described as "stringers," each operator is capable of inserting 300 cord fasteners during a working day. Clamps, clipped on with a pair of shears, are put on the ends of the cord to prevent the material from fraying. Thus, Uncle Sam in the rôle of manufacturer, completes the process of making mail containers, the capacity of the mail equipment shops being 4,000 new bags when two eight-hour shifts constitute the production forces. The containers are conveyed to the second floor of the building, packed in units of 20 bags each, and labeled with the name of the office of its destination. Shipping instructions are furnished by the railway mail service, which has jurisdiction over the distribution of mail equipment. Bulk lots of the sacks are loaded on motor trucks and transported to the depot where mail cars usually distribute them in wholesale consignments to principal cities like New York, Chicago and St. Louis.

Subject to the rough handling on railways and at the stations and post offices, the life of a mail sack is of indeterminate length. Barely possibly one may weather the stress of use for 15 or 20 years or more likely the new sack on its second journey has to be consigned to the repair shop. The life of the average sack is computed to be only four years. Obviously, Uncle Sam needs a repair shop as well as a manufacturing establishment—in fact, a salvage department operates in conjunction with the latter. Approximately 10,000 sacks are received daily at the mail equipment shops in need of "doctoring," the mishaps varying from a ripped seam to a decapitated head. Salvaging is practiced as such a fine art that two half bags may be refashioned into a usable container. Where darning only is necessary, the repair machine rescues 160 bags a day, whereas patches can be placed at the rate of 80 every 16 hours.

Defective sacks, or "bums" as they are picturesquely described, necessarily accumulate dust as they are thrown in a pounding fashion from trains and otherwise subjected to ill treatment at stations and post

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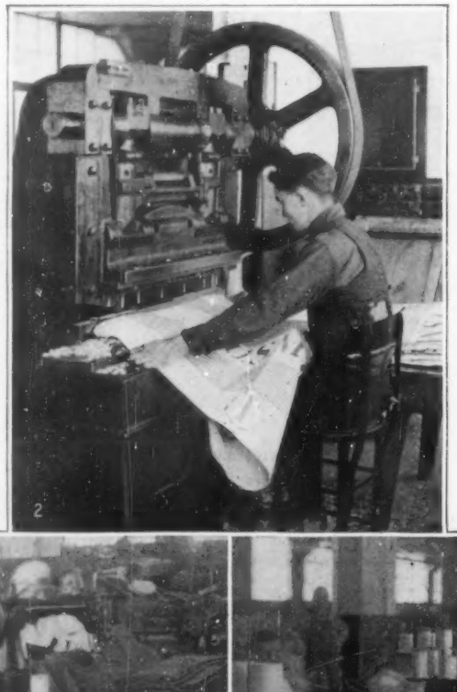


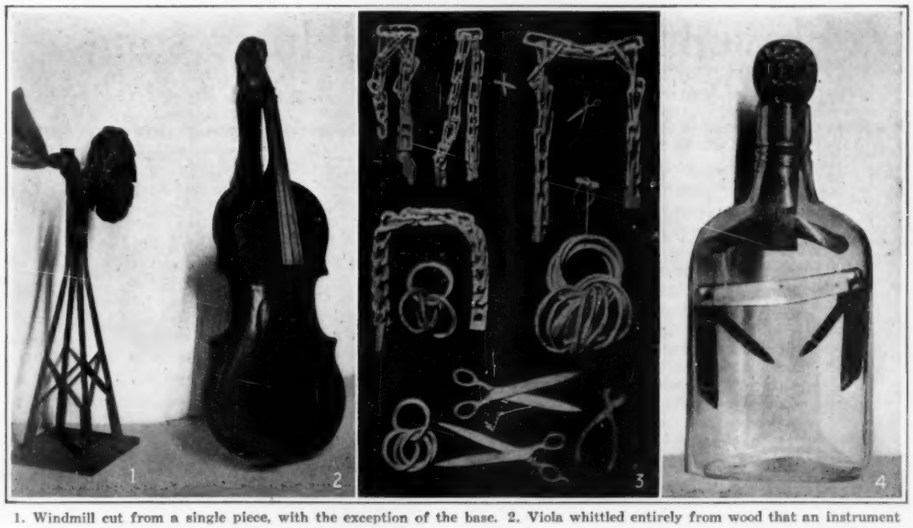
1. A section of the mail equipment shops where "bum" mail bags are salvaged. Each machine repairs 160 bags a day, or places 80 patches. 2. This machine punches 13 holes at a single operation, for the placing of grommets or eyelets in mail bags. Before this mechanism was designed by the mail equipment shops, one hole at a time was punched. 3. General interior view of the mail equipment shops, where mail sacks are made and repaired by sewing machines

Activities in the mail equipment shops, where mail bags are repaired for further service

The Whittler's Museum

MR. G. E. WILLIAMSON, of Los Angeles, takes his pen in hand to controvert the suggestion made in our issue of August 7th last, that the bunch of interlocking rings there illustrated as emanating from the facile knife of Mr. A. T. Cook represents the last word in whittling stunts. Mr. Williamson is a good deal of a whittler himself, as the exhibits which he sends and which we reproduce here attest.

The little windmill is cut, with the exception of the flat base, from a single piece of wood 1 by 2 by 22 inches. The mill turns on the tower, and the wheel turns independently. We gather from Mr. Williamson's description that in addition to actual cutting, he permits himself to bend the uprights, etc., into the desired positions. The miniature violin which stands beside the mill is another admirable sample of the gentle art of skilled whittling.



1. Windmill cut from a single piece, with the exception of the base. 2. Viola whittled entirely from wood that an instrument maker would have rejected. 3. A collection of interlocking rings, chains, and shears and pliers with real joints, each item cut from a single piece of wood. 4. A curious bottle assembly, the knife being too fat to be inserted in the bottle closed and too long when opened; yet there it is.

A few surprising tricks of the whittler's trade

The real tricks of Mr. Williamson's trade however are the pieces attached to the cardboard stand which form the background of our second picture. The bunch of interlocking rings comprises 16 rings, each of which passes through all the others. These are cut from a block of wood 6 by 6 by 1¾ inches, and represent a small edition of Mr. Williamson's masterpiece — a group of 50 rings cut from a block 8 by 8 by 15.

The master whittler cuts chains in twelve different patterns. From a block 6 by 6 by 2 inches he has cut an endless chain 9 feet long. From a stick 2 by 2 by 30 inches he turns out a chain every link of which runs through twelve other links, or twenty others, at pleasure. He considers the shears to be the most complicated joint he has ever cut, since each blade passes through the other, while they function perfectly. The pliers likewise "work" as pliers ought.

In addition to his ordinary whittling stunts, Mr. Williamson does a lot of "bottle tricks," which means the assembling of complicated articles inside bottles. He regards as his masterpiece in this class a barrel 3 inches in diameter and 4 inches high, having 16 staves, 4 pieces in each head, and 6 hoops each nailed on with 4 nails; the entire outfit assembled inside a quart whisky bottle.

Another curiosity is the bottle assembly which we illustrate. The knife was too fat to go into the bottle closed, and too long opened; so the first two blades were closed after being inserted to allow the last two to enter, after which the first two were reopened. It goes without saying that the cords suspending the knife were put in place and tied inside the bottle.

Fossil Footprints of Texas

A LETTER to the Smithsonian Institution from Mr. George F. Bessent of Glen Rose, Texas, tells of the discovery in a rock formation near that place of a considerable number of large three-toed footprints. These are of great scientific interest since they are the first fossil tracks to be reported from the State of Texas, and also because they definitely record the occurrence in that region of some large animal whose presence there in Lower Cretaceous times was previously unknown to scientists.

Herbivorous dinosaurs of primitive type restored from the data furnished by their footprints

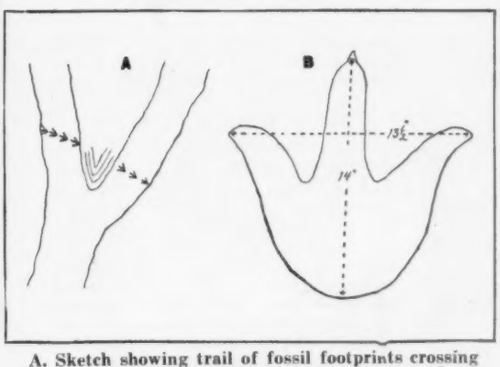
With Mr. Bessent's kind permission we are enabled to reproduce here a photograph of four of these footprints, showing how they occur in the rock. Quoting from his letter he says: "There are seven tracks in the bed of two forks of a little branch, and we found more by digging in the banks on each side. Other footprints have been unearthed until we have a total of thirteen. One of these tracks was buried under about 8 feet of rock and soil. The owner of the land will not allow any of the tracks to be taken up at least for the present."

A sketch enclosed in the above-mentioned letter shows the manner of their occurrence in a long single row, which if the point of land between the forks of the stream bed was excavated would undoubtedly form one continuous series of tracks. A full-sized sketch of one of these tracks shows that it had a greatest length of 14 inches, and that the toes had a spread of 13½ inches. The toes are sunk three inches deep into the rock. The tracks, Mr. Bessent says, "are about four feet apart," thus in thirteen steps the animal that made them covered a distance of 52 feet.

A comparison of these foot impressions with others whose origin has pretty certainly been determined through careful and detailed study, shows them to be so alike as to leave but little doubt that they were made by similar large, three-toed bipedal reptiles, known as dinosaurs, but as to which particular kind of dinosaur was responsible for the tracks is not so easily determined. The best key to these ancient hieroglyphics would of course be the discovery of the actual skeletal remains associated with the footprints, or if found elsewhere, in a rock formation of equivalent age. Unfortunately in this case, no fossil bones of an animal of large enough size to have made these tracks has ever been found in Texas or elsewhere in rocks of equivalent geological age, so that at present we cannot expect any help from that source in solving this riddle of the rocks.

Fossil footprints found in the rock near Glen Rose, Texas. These footprints occur in rock that has been uncovered

Footprints of an herbivorous dinosaur showing where the animal rested (Amherst collection)



A. Sketch showing trail of fossil footprints crossing the two forks of a stream bed. B. Drawing showing the shape and dimensions of the tracks

The footprints with which they have been compared and to which reference has been made are those found in the valley of the Connecticut River in New England, a region that has long been famous for the abundance of four of these footprints, found there, and the excellence of their preservation. The studies by the late President Edward Hitchcock of Amherst College resulted in the description and publication of more than 100 kinds of track-making organisms. At first these were thought to be bird tracks, but this idea was largely dispelled under a more critical examination which showed the presence of dragging tails, small fore feet and impressions of

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Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

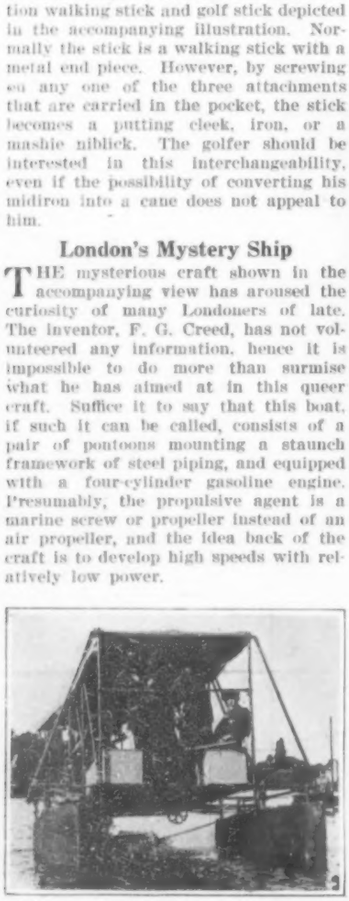
Walking stick that may be converted into golf stick by screwing on proper club head

Making the Golf Stick and Walking Stick One

FOR the business man who occasionally likes to get away from the routine of his work in order to enjoy a game of golf, an enthusiastic British golfer, J. E. Wilson, has invented the combination walking stick and golf stick depicted in the accompanying illustration. Normally the stick is a walking stick with a metal end piece. However, by screwing on any one of the three attachments that are carried in the pocket, the stick becomes a putting cleek, iron, or a mashie niblick. The golfer should be interested in this interchangeability, even if the possibility of converting his midiron into a cane does not appeal to him.

London's Mystery Ship

THE mysterious craft shown in the accompanying view has aroused the curiosity of many Londoners of late. The inventor, F. G. Creed, has not volunteered any information, hence it is impossible to do more than surmise what he has aimed at in this queer craft. Suffice it to say that this boat, if such it can be called, consists of a pair of pontoons mounting a staunch framework of steel piping, and equipped with a four-cylinder gasoline engine. Presumably, the propulsive agent is a marine screw or propeller instead of an air propeller, and the idea back of the craft is to develop high speeds with relatively low power.

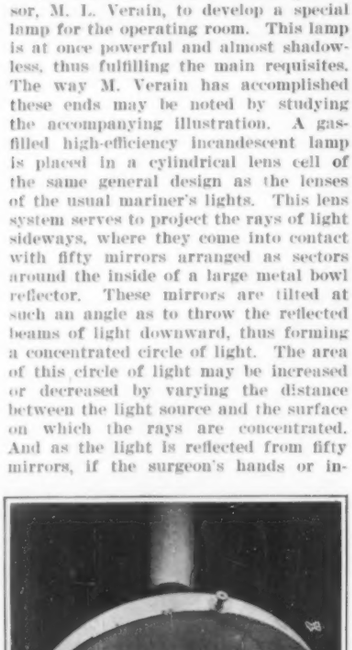


Odd craft which has recently appeared on the Thames and attracted attention of Londoners

A Shadowless Light for the Operating Room

SATISFACTORY illumination is one of the problems confronting the modern surgeon. For one thing the illumination must be concentrated and powerful, but still more important it is to have a shadowless illumination if possible. The hands and instruments of the surgeon and his assistants have a most awkward tendency to get in the way of the source of illumination and shut off the light at the very point where it is required most urgently.

It has remained for a French professor, M. L. Verain, to develop a special lamp for the operating room. This lamp is at once powerful and almost shadowless, thus fulfilling the main requisites. The way M. Verain has accomplished these ends may be noted by studying the accompanying illustration. A gas-filled high-efficiency incandescent lamp is placed in a cylindrical lens cell of the same general design as the lenses of the usual mariner's lights. This lens system serves to project the rays of light sideways, where they come into contact with fifty mirrors arranged as sectors around the inside of a large metal bowl reflector. These mirrors are tilted at such an angle as to throw the reflected beams of light downward, thus forming a concentrated circle of light. The area of this circle of light may be increased or decreased by varying the distance between the light source and the surface on which the rays are concentrated. And as the light is reflected from fifty mirrors, if the surgeon's hands or instruments cut off part of the rays there are others that are not cut off and thus supply the required illumination.

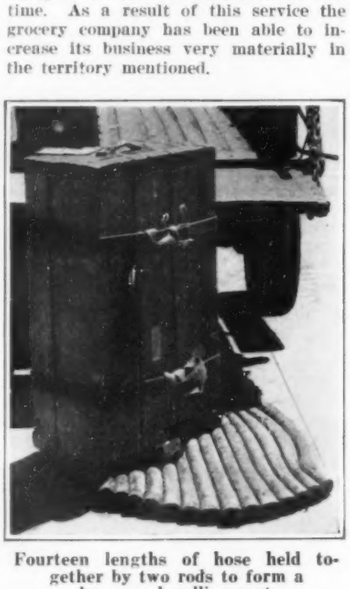


Copyright, Keystone View Co.

Newly-developed lamp for use in operating rooms where shadowless illumination is essential

Motor Truck Reliable on Suburban Hauls

DURING the last two years, a firm which has been making suburban hauls for a wholesale grocer of Chicago has kept an accurate record of the service rendered by a standard two-ton motor truck. The machine was bought in the summer of 1918 and during the six months from July 1, 1919, to January 1, 1920, it piled up a distance of 7,402 miles, having operated 153 days out of a possible 154. This machine is in daily service between Chicago and the towns of South Chicago, Homewood and Hammond, making an average daily run of 48.39 miles with 30 stops, and frequently returning to the wholesale house in time for a short haul in the Loop District of Chicago. Formerly all these groceries were shipped by express or freight, but the motor truck has proved cheaper and saves an untold amount of time. As a result of this service the grocery company has been able to increase its business very materially in the territory mentioned.



Fourteen lengths of hose held together by two rods to form a baggage-handling mat

A Shock-Absorber for the Roughly Handled Trunk

TRY as hard as they may, our present-day "baggage smashers" cannot injure a trunk when dropped on the ingenious rubber mat depicted in the accompanying view. The mat consists of fourteen pieces of rubber hose held together by two rods. The resilient action of the pieces of hose makes it possible to drop a heavy trunk on them from almost any reasonable height without injury to the piece of baggage.

More Land for Food Production

DURING the past three years it is said that 1,239,959 horses and mules have been shipped from the United States to foreign countries, the greater portion of these animals having been used in war service. It may be interesting to know that this great exportation of draft animals in no way taxed our supply of available animals, but, due to the increased use of motor trucks, a surplus of some half-million horses and mules is available.

More than 600,000 motor trucks and other commercial automobiles are now in use in the United States and they have displaced approximately 2,000,000 horses and mules. Analysis of available records shows that motor vehicles have not only released these animals, but have also released the 10,000,000 acres of land necessary to feed them and made these millions of acres which are so badly needed available for the production of food for mankind.

It is estimated that motor trucks haul 1,800,000 tons of goods annually, at a cost of eighteen cents per ton-mile. With horse-drawn vehicles, the cost of transportation is increased to twenty-four cents per ton-mile.

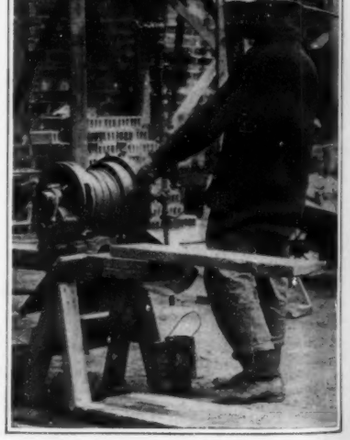
Pliers-wrench that may be used in place of a monkey wrench in confined places

Pliers That Take the Place of the Monkey Wrench

LOCKING itself on any sized nut simply by continued pressure on the handles, the recently developed pliers-wrench shown in the accompanying illustration is particularly adapted to reaching into almost inaccessible places, where it is not always possible to work a monkey wrench. Once the jaws are set upon the nut a continued pressure on the handles locks them in that precise position, but the locking device is immediately released when the pressure on the handles is released. By sliding the catch of the locking device, the pliers-wrench becomes a pair of pliers so that the pressure of the hand keeps a continual—instead of a locked—pressure on whatever is held in the jaws.

A Tiny Hoist for All-Round Jobs

THE hauling of material in shipbuilding yards, in the erection of buildings, and in highway grading has hitherto required the setting up of an extensive hoisting system which cannot be readily moved from place to place as the work progresses. To the end of simplifying this phase of construction work of all kinds, there has been introduced of late a simple host of compact dimensions, shown in the accompanying illustration. This hoist, or little "tugger," can be mounted in tight places hitherto inaccessible to the usual hoisting equipment. It weighs only 285 pounds, and measures 21¼ inches wide, 16½ inches long, and 20⅛ inches high. It is operated by compressed air or steam and develops a surprising amount of power.



Using the tiny hoist in building operations to hoist wheelbarrows filled with bricks

Man-Killing Insects

(Continued from page 321)

frequent visits to the skin of the individual in search of his food, the host's blood. The eggs are laid in the fabric of the clothing. These hatch in a few days and the adult state is reached in fifteen days. The eggs may remain dormant on clothing removed from the person as long as forty days. As many as ten thousand lice have been found upon a single individual.

The prevention of the spread of typhus fever may be classed under three heads: The preventation of lice infestation among the people in general; destruction of the parasites and their eggs found on the person and in his clothing and effects; the prevention of persons who come in contact with typhus fever patients from being infested with lice. The cessation of the Serbian epidemic was dependent upon the wholesale washing and delousing of the population. Special trains and depots were equipped to carry on this work most expeditiously. It was necessary that all lice on the body and in the clothing of the person be destroyed. The clothing was removed in an outer room. The body was anointed with a petroleum preparation and then a hot bath was given. In the meantime the clothing was being treated by means of live steam in a sterilizing machine so that when the person had completed the bath, his clothing was ready. Some delousing plants were of sufficient size to look after fifteen thousand men in one day.

The Housefly and His Work

The common housefly is the most filthy of insects. From the body of a dead animal, from the manure heap, from the garbage can, from the receptacles of human excreta, the fly will journey directly to the food in the kitchen or on the dining table, lighting on the butter, milk, sugar and other edibles. The "fly-line" is the shortest distance between filth and food. Millions of germs or bacteria have been found attached to the body, wings and feet of this insect, and disease germs have been known to pass through a fly's digestive tract without harm to the bacteria. Flies found in the neighborhood of houses containing typhoid fever patients have been discovered to be carrying typhoid bacilli.

The fly lays her eggs in some filth pile and in a few days the maggots or larvæ emerge from the hatched eggs. After a week or less the maggots enter the pupal or resting stage, and in a few days the adult fly comes forth from the puparium. The descendants of a single pair of flies may number over 25 millions in 40 days.

Besides typhoid fever, flies may transmit the infection of cholera, dysenteries, infantile diarrhoea, erysipelas, smallpox, yaws, hookworm disease, sleeping sickness, diphtheria and many other diseases.

Cholera was and is one of the world's greatest scourges. Millions of the earth's inhabitants have fallen before the onslaught of this disease. Great outbreaks covering large parts of the surface of the earth have occurred. The pandemics usually take their origin from the endemic home of cholera, the region about the mouth of the Ganges River in India. From here it spreads possibly to the rest of Asia, or into Africa or Europe, and no less than eight times have its claws fastened upon American soil. The cholera germs have been known to live within the body of the fly for a period of several days.

The Malaria Mosquito

The mosquito is the greatest disease-carrying insect that we have in the United States, and this specifically in its relation to the transmission of malaria. No state in the Union may be said to be free of malaria. In the southern states it is especially prevalent. Being a chronic disease, the reported cases are only a fraction of the actual cases that exist. In 1914 it was estimated that there were 138,000 cases of malaria in the state of Arkansas.

So far as scientists are aware, malaria is transmitted in no way except by the mosquito, and only by the anopheline type of mosquito. Although this mosquito was considered as a wild or semi-wild mosquito it very frequently breeds in close proximity to habitations. It breeds in rain water barrels, cisterns, and especially in small streams, ponds, swamps and water collections. At times it will be found in the most inconspicuous places.

The adult female mosquito lays her eggs on the surface of the water; in a day or two the eggs are hatched and the larva or "wiggle-tail" makes its appearance. After the larval period of seven to fourteen days the pupa or "tumbler" forms. In another four or five days the adult mosquito emerges from the pupal case. The length of time from egg to adult form varies greatly with the weather conditions.

Although the "wiggle-tail" and the "tumbler" live in the water, they are air breathers and must necessarily come to the surface of the water to get air. This property is made use of in the control of mosquito breeding. If the surface of a body of water is sprayed with crude petroleum or kerosene a very thin oily film will form upon the water and when the "wiggle-tail" and "tumbler" come to the top to breathe, their respiratory or breathing tube becomes blocked by the film of oil and suffocation follows. Only the female mosquitoes are supposed to bite and suck blood. The male of the species usually feeds upon the juices of plants and fruits and is probably harmless so far as disease dissemination is concerned.

Anopheline or malaria mosquitoes may be distinguished from other types of mosquitoes by two important characteristics: The larva or "wiggle-tail" of the anopheles when at the surface of the water lies parallel to it, whereas the larva of other than malaria mosquitoes hangs at an angle to the surface with the head down into the water. Also the adult malaria mosquito when resting on the wall has its body pointing outward at an angle to the surface, while other mosquitoes rest with the bodies parallel to the surface of the resting or supporting plane. It may be said in general that the malaria mosquitoes have spotted wings.

Malaria is caused by a very minute animal organism getting into the blood of a person. This small animal cell really leads a double life, one within the body of man and the other in the mosquito. It does not simply pass through the insect but undergoes a definite cycle within the body of the mosquito. This development takes about twelve days, therefore a mosquito which has obtained the organisms from a malaria patient cannot carry the disease to other persons until after the lapse of the period. In certain diseases as typhoid fever, smallpox, scarlet fever and measles, a great degree of immunity is conferred upon the persons having the diseases, and second attacks of these maladies are rather rare. This is not the case with malaria, for a person who once has the disease is more likely to have subsequent attacks.

The battle against malaria is twofold; a fight against the malarial organisms in man and a campaign against the mosquito. Mosquitoes should not be allowed to attack well persons nor those individuals having malaria. Mosquito bars or netting attached to all beds are requisites in malaria communities. The proper screening of the houses is necessary. The killing of the adult mosquitoes in the house is of prime importance. Although all of these measures are very useful the main point of attack is upon the breeding places of the mosquitoes, that is, all collections of water, however minute,

Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farming Implements, Etc.

Pertaining to Aeronautics

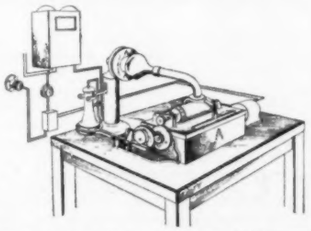
AIRPLANE.—W. F. OSBORNE, Wagon Mound, New Mexico. The invention relates more particularly to airplane wing structure and control. The prime object being the provision of a folding wing structure which will permit of housing an airplane in minimum storage space. A further object is the provision of a folding structure by means of which the wings may be rigidly held in normal outstanding position or folded against the fuselage so that the machine in disuse may be housed in approximately one-third of the space it would occupy with the wings outstanding.

Pertaining to Apparel

CHILD'S AND LADY'S GARMENTS.—A. C. BERRY, 35 Rowan St., Winfield, L. I., N. Y. The invention relates to union garments in the form of an outside piece of apparel or a piece of underwear or the like. The invention has to deal particularly with the portion of the garment covering the body from the waist down to the knees and embodies a skirt and bloomer legs so designed that a neatly appearing garment is produced with a minimum of material and without bulkiness at the bloomer legs, whereby freedom of motion is obtained as well as the proper set of the skirt.

Electrical Devices

TELEPHONE ANSWERING INSTRUMENT.—W. D. CALVERT, 1420 12th Ave., Altoona, Pa. This instrument is a mechanical device so arranged with a phonograph or dictaphone that it will answer a telephone when a party calls and the person called is out or so engaged that they cannot immediately answer the phone. The object is to provide an instrument which has instrumentalities for raising the telephone receiver and speaking a stereotyped message into the transmitter, both of said actions being automatically initiated upon the ringing of the telephone bell.



VIEW SHOWING THE INSTRUMENT APPLIED TO A DESK TELEPHONE

SYSTEM OF ELECTRICAL CONTROL.—C. F. SMITH, Box 443, Cle Elum, Wash. An object of the invention is to provide a device which will automatically connect the main feed wires with the distributing system leading to a mine, whenever power is used in the mine or in connection with mining work, and will automatically cut off the general distributing system from the feed wire when the current is no longer in use thereby rendering the wires of the distributing system harmless as far as accident to the workmen or fires caused by short circuits are concerned.

Of General Interest

STAKE LOCK.—R. DYMOCK, Hamburg, N. J. An object of the invention is to provide a means for removably locking a stake in a pocket, such means as will be simple and practical in construction, and durable in use, and comparatively cheap to manufacture. A further object is to provide a stake lock which may be utilized on wagon bodies, motor trucks, flat cars and various other vehicles where stake locks are employed.

NAIL BUFFER.—I. CLAIR, 1035 53rd St., Brooklyn, N. Y. The object of the invention is to provide a construction wherein the buffing part may be readily removed and a new one substituted. Another object is to provide a buffer in which the buffing leather or material may be reversed, and a removable padding means whereby the tension of the buffing surface may be varied.

ICE CREAM FREEZER.—F. G. SCOTT, 1501 Seegar St., Dallas, Texas. The invention has for its object to provide a freezer wherein the stirring paddle is of the oscillating type and wherein means is provided in connection with the paddle for thoroughly stirring the mixture during the operation of freezing, especially that part adjacent to the walls of the container.

ROCKER SWING.—J. W. BUNT, 2349 Grover St., Denver, Colo. An object of the invention is to provide a swing which will maintain a pendulum-like momentum for a relatively long period when said movement is initiated and requires but slight exertion to operate the swing. A further object is to provide a construction of swing of the lawn type which is strong and durable, yet relatively light in weight.

UMBRELLA DRAINING CUP.—D. R. BAITY, c/o E. K. Madel Pat Casey Agency, Putnam Bldg., New York, N. Y. This invention relates to an attachment for umbrellas, and has for an object to provide a structure which may be easily applied and removed and which may act as a drainage cup to permit the passage of water from the umbrella when the umbrella is folded and held in a vertical position.

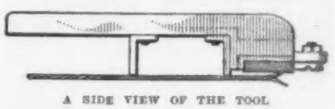
STILL.—H. P. HIRD, "Moor End" Dewsbury, England. The invention refers more particularly to a still adapted for the manufacture of pitch carbon from coal tar pitch and the like. The object is to provide a still which is so constructed that the material can be easily introduced and from which the resulting residue can be readily and quickly removed. A further object is to provide a still in which the body consists of a standardized and easily procurable element such as a cast-iron pipe elbow.

Hardware and Tools

TRAP ANCHOR.—W. R. LAZENBY, Box 415, Hardin, Mont. An object of the invention is to provide a simple and efficient anchor including separable means which permits of a quick attachment or detachment and which eliminates any accidental separation of the parts when once assembled. Another object is to provide a trap anchoring device which is especially designed to permit of the application of the same within a depression whereby the chain secured to the trap may be normally nested in the depression in an out of the way position.

LOOM PICKER HEAD.—H. M. OEMENT, Box 475, Schoolfield, Va. The invention relates to loom picker heads of that type which is comprised of laminations of leather. It is the purpose of the invention to prolong the life of picker heads of this character by interposing a plate of metal, preferably steel between the laminations in such manner that the entire head as a unit is reinforced against detrimental action of the shuttle.

SAW SET DRESSING TOOL.—E. G. S. CLARE, c/o Genl. Deliv., Seattle, Wash. The invention has for its object to provide a device especially designed to be used after the saw is set and jointed and before filing, to dress down the set in each tooth, until all the teeth are in the same plane with each other, thus making a perfect set and to remove the wire edge from the teeth after filing.



A SIDE VIEW OF THE TOOL

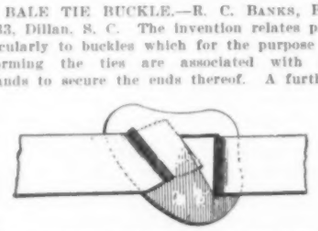
COMBINATION KEY BARREL CONSTRUCTION.—F. CLARK, 6 Calle de Juarez 82, Durango City, Mexico. An object of this invention is to provide a combination key so arranged that a plurality of adjustable ward members may be provided in a minimum space, so that they may be readily adjusted to various combinations corresponding to the setting of tumbler members of a lock, without the necessity for the use of movable stops and spring members.

CUTTER.—L. VERCOUTERE, 1015 W. 4th St., Pittsburgh, Kansas. An object of the invention is to provide means for securing a cutting blade at any desirable longitudinal adjustment relative to its support, so as to regulate the depth of the cut. A further object is to provide a cutter which is capable of a wide range of utility in connection with various arts.

TRAPPERS' TOOL.—W. R. LAZENBY, Box 45, Hardin, Mont. One of the principal objects of this invention is to provide a nearth boring tool which is constructed and designed as a

means for preparing the ground to permit of the positioning of a trap and trap anchor. Another object is to provide a folding tool, the several parts of which are capable of being nested to occupy a minimum amount of space and which when in folded condition protects the pointed end of the driving shank.

BALE TIE BUCKLE.—R. C. BANKS, Box 133, Dillan, S. C. The invention relates particularly to buckles which for the purpose of forming the ties are associated with tie bands to secure the ends thereof. A further



VIEW SHOWING THE BUCKLE IN THE LOCKED POSITION

purpose is to provide a buckle which is so constructed and adapted to be related to the engaging ends of a tie band as to permit of its shifting movement on an axis between the tie band end so as to twist itself and one of the tie band ends into firm gripping and non-slipping relation.

TRY SQUARE HANDLE.—G. E. MACONNELL, Jamestown, N. Dak. This invention has for its object to provide a handle of the character specified wherein the said handle is rabbeted on one face to be flush with the face of the try square for permitting mortises to be marked easily and expeditiously.

COMBINATION LOCK.—B. C. PATTERSON, 1111 W. 15th St., Oklahoma City, Okla. The invention relates to combination locks applicable to carburetors of automobile engines. An object is to provide a lock by means of which the needle valve of a carburetor may be locked to prevent gasoline flowing into the carburetor, when desired, thereby tending to prevent theft of the car.

CLOTHESPIN.—G. W. WALKER, 2207 Seminary Ave., Oakland, Cal. The prime object of the invention is to provide a clothespin which includes a double or compound anchor grip for the clothes. A further object is to provide a clothespin which will be cheap to produce, easy to manipulate and capable of offering a practical solution of the difficulties experienced with many devices of this kind.

ACTUATING DEVICE FOR TEMPER SCREWS.—M. G. GUTHRIE, 506 4th Natl. Bank Bldg., Wichita, Kan. The invention relates to temper screws used in the drilling of wells and more particularly to a device for actuating the same. It is the purpose of the invention to eliminate danger by providing a device which prevents the jerking movement of the pole, used for effecting adjustment, in the direction of the operator, while at the same time locking the pole to the temper screw in its forward movement so that the proper adjustment may be effected.

Heating and Lighting

HOUSE WATER HEATING ATTACHMENT FOR RANGES.—J. E. and J. ZIMMERMAN, 4 Tesla Place, Glendale, L. I., N. Y. Among the objects of this invention is to provide a special water back for a cooking range calculated for use in winter or cold weather for heating water as a basis of a circulating system of house heating. The object is to adapt the cooking range for house heating purposes and yet not interfere with the ordinary functions of the range for cooking or the heating of the water in the adjacent kitchen boiler.

within a certain radius of the community. The suppression of malaria by means of mosquito control is being more and more recognized throughout the world as the promising way of meeting the malaria problem. A number of our own states are now engaged in such campaigns. Arkansas is making great headway in this regard. Probably the Panama Canal Zone is one of the best classical examples of malaria suppression by mosquito control.

The Hudson River Bridge

(*Continued from page 324*)

pendous proportions of the later structure.

The over-all length of the Hudson River Bridge from anchorage to anchorage will be 6,660 feet, and the length between the main towers of the central river span will be 3,240 feet. At the towers the clear height from mean high water to the under side of the bridge will be 140 feet, and at the center of the channel it will be 155 feet. The floor system, which will be a double-deck structure 220 feet in width and 34 feet in depth, will be suspended from four cables arranged in pairs, with a horizontal distance between them, center to center, of 165 feet. Each pair will hang in the same vertical plane at a vertical distance of 60 feet center to center. Due to the fact that the cables will be braced by a system of vertical tension and diagonal compression members, as shown in the elevation, each pair will be secured against deformation, and will serve the function of a stiffening truss. The width of each panel of this trussing will be 60 feet, and the floor of the bridge will be supported from each panel point by eye-bar suspender chains. In the old Brooklyn Bridge and the other East River suspension bridges the cables consist of steel wires laid parallel and bound up into a cable of circular cross section. In the Hudson River Bridge, each cable will consist of 80 eye-bars arranged in three banks. The diameter of each cable, as thus assembled, will be about 11 feet—in the Brooklyn Bridge the diameter of each cable is 15 inches. As a protection against the weather, the cables will be enclosed in watertight bronze tubes, which will measure fifteen feet in exterior diameter. This will protect the cables from the weather and will provide sufficient clearance for the workmen to inspect the cables and paint them at the long intervals of many years when repainting becomes necessary. Incidentally, the bronze covering will add to the artistic and monumental appearance of the bridge.

The main towers, which will be built upon concrete foundations extending to bed rock, will be carried up to a height of 750 feet above mean high water, or practically to the same height as the Woolworth Tower. They will be built of steel and covered, from water level throughout their full height, with smooth-dressed, light-gray granite, which will serve as a protection to the steelwork against the weather and will, of course, add greatly to the architectural beauty of the whole bridge. The upper roadway of the bridge will pass through the towers by means of three arched openings, the center one measuring 155 feet in width by 100 feet in height, and the side openings being 30 feet in width. In view of the fact that there is a preponderance of sentiment in favor of utilizing the monumental proportions of this bridge in working out a suitable war memorial, it is evident that this three-arched entrance, with its vast spread of granite wall space will lend itself most admirably to the purpose, providing ample space for heroic statuary and commemorative bronzes and tablets.

On the landward side the cables will swing down to masonry anchorages on each shore. These, like everything connected with the bridge, will be built on a gigantic scale, the pull of the cables necessitating the emplacement of an enormous mass of masonry to provide the necessary frictional resistance. Each anchorage will measure 300 feet in width by 400 feet in length, and that on the Manhattan side will extend about 200 feet above ground level. The traffic will pass through the center of these anchorages, and here again there will be a vast portal, consisting of one central and two smaller flanking arches, which will lend themselves to war memorial decoration.

The floor of the bridge presents some of the most original features of the whole structure. The make-up of the floor system consists essentially of a series of great transverse plate girders, or floor beams, spaced 60 feet apart and connected to the cables above by eye-bar suspenders. Each floorbeam is actually a plate girder 34 feet deep by 200 feet long, stiffened and connected to the adjoining floorbeams by heavy plate girders or stringers. The upper deck is reserved mainly for vehicular traffic, and the lower deck is given up to trunk line freight and passenger traffic. On the upper deck, between the cables will be provided a broad boulevard 155 feet in width, with a trolley track adjoining the cables on each side. On the outside of each cable will be a rapid transit track and a 15-foot footwalk. The whole of the upper deck will be covered with a steel plate flooring overlaid with concrete. The lower floor will be given up to the service of trunk line traffic, both freight and passenger. Originally, it was proposed to provide two moving platforms at the center of the lower floor. These, however, will probably give place to standard railroad tracks so that the ultimate capacity of the lower deck will be for ten railroad tracks capable of accommodating the heaviest freight and passenger trains.

The surface of the upper deck will be made watertight, so that the whole floor system, in addition to the towers and cables will be protected from the weather. This will result in cutting down the cost of repairing (always a heavy part of the maintenance costs of a bridge) to a minimum. In fact, fifteen per cent only of the steelwork of the Hudson River Bridge will be exposed to the water.

The principal stresses to which the bridge will be exposed will be those due to its own dead load. So great is this that, even with the bridge loaded to capacity, the live load would cause a comparatively negligible addition to the dead load stresses. The same thing is true of the wind loads. The great width of the extremely rigid floor system, coupled with the inertia of the bridge, serves greatly to simplify the problem of providing against wind stresses.

The estimated cost of the bridge itself in round figures is 100 million dollars; the freight classification yard in New Jersey, 25 million dollars; the Union passenger station, accommodating the trains of all the roads that come in from the west and north, 30 million dollars; the double-deck elevated railroad down West Street to the Battery, 30 million dollars. The cost of the electrification and equipment of the whole system is set down at 25 million dollars, making a total cost of 210 million dollars for th ewhole scheme.

The yearly traffic across the Hudson River in round figures for the year 1920 was as follows: Passengers, 200 million; draft vehicles, 10 million; freight: coal, 12 million tons, miscellaneous freight, 8 million tons. The present rate of increase indicates that by 1930, or about two years after the bridge is completed, the total traffic across the river will be 250 million passengers, 22 million vehicles and 25 million tons of freight; and it is estimated that of this total, something over one-half will be diverted to the bridge. After the year 1930, it is expected that the traffic across the river via the bridge will grow at an increasing ratio, and particularly the passenger traffic. This expectation is based upon the rapid growth of traffic across the East River with the completion of the bridges and tunnels.

The gross revenue for passengers, vehicles and railroad freight is estimated at 45 million dollars per year during the first year of operation, and in ten years after completion, it is estimated that the revenue will have risen to over 60 million dollars per year. This amount does not include rentals from warehouse and storage buildings which will subsequently be erected.

Milk Without Cows

(Continued from page 325)

that the bottles coming from the machine could be conveyed by trucks directly into the milk room for storage. A galvanized-iron tank used for the washing of cans, which process was committed to hand labor, together with a rinser and steamer, was situated against the south wall of the washing room. A brush washer, for scrubbing extremely dirty containers was located on the north wall of the room.

A two-effect water still, with a capacity of 350 gallons an hour, was stationed on an elevated platform in the southwest corner of the washing compartment. The effluent pipe from this still projected through the wall into the milk room and discharged into a tin-lined distilled-water storage tank of 1,000 gallons capacity. The storage tank, being connected by a tin-covered piping to the suction end of the milk pump, at this juncture permitted the placing of a three-way valve, whereby the liquid could be drawn from either the distilled water tank or the buttermilk machine as desired. The discharge from this pump also facilitated the conveyance of the effluent either into a weighing can on a platform near the skimmed-milk vat or to the mixing vats on the balcony. A field laboratory, located in the dressing room, determined the bacteriological content of milk and its products as well as the acidity and fat in milk. A 15-ton refrigerating machine preserved the milk as well as the cold-storage department of the commissary. The rooms were cooled directly by the expansion of compressed ammonia, the compressor being propelled by a 30-horsepower motor. Brine, cooled by the expansion of ammonia, was employed in cooling the products of the mechanical dairy, the brine being circulated by a steam-driven pump.

The purest of water is essential in the making of reconstructed milk, the Nitro water supply having been previously filtered and chlorinated. As with institutions and men—the former being but the shadows of great or small personalities—reconstructed milk in its finished form cannot exceed the quality of the ingredients contained therein. The water should be distilled; otherwise, mineral salts may be conducive of harmful results to infants in partaking of the milk. The hard waters of the Middle West and those containing an excessive percentage of sulfate illustrate the point.

The skimmed milk powder used at the Nitro manufacturing plant was dissolved by a machine of 300 gallons capacity, the unit being equipped with a revolving heating coil to which blades were attached, serving the functions of agitator and heater at the same time. The vat should be of cylindrical bottom, and should permit of no quarters for undissolved powder. The requisite volume of distilled water is poured into the vat and a weighed ratio of powder added. A sugar scoop can be used in removing the powder from the barrel into the vat. The coil agitator is in operation as the powder is being conveyed to the vat, and the temperature of the water while the powder is being dissolved ranges from 70 to 80 degrees Fahrenheit. Having completed the dissolving process, the skimmed milk is pumped to one of the mixing vats. Here prescribed quantities of butter, already parceled into 4 inch cubes on the porcelain topped table are added and the mixture brought to a temperature of 146 degrees Fahrenheit where it remains con-

Testing Power Blades

One method of testing power blades, which is at least fair to all, is to purchase several blades of each of such makes or brands as it is desired to test, buying one blade of each kind tested from at least three different merchants if possible, in order to get an average run of the product. The blades tested should be of the same length, gage, depth, and "pitch" for each of the different makes, unless one or more of the manufacturers makes some specific recommendations as to the type of blade to use on the material on which the test is to be conducted. Where such recommendations are made they should be scrupulously observed. The blades should all be tested on the same grade of material and in the same power machine, preferably one with gravity feed. The reason for testing all of the saws on the same kind, size and shape of material is obvious. Should the test be made, as is usually the case, on unannealed tool steel, the blades should be alternated, so that should the steel not be uniform no saw will be placed under a handicap by a hard spot.

Observe Manufacturers' Recommendations

One point, however, must not be overlooked. Some manufacturers have given the question of Hack Saw efficiency sufficient thought to evolve certain specific recommendations as to the blades, strokes per minute and weight to be used on certain classes of materials and with certain machines. If any of the manufacturers of any of the saws to be tested makes any definite recommendations as to what blade to use under the conditions of the proposed test, they should be rigidly adhered to. Otherwise, ignorance of some of the factors that entered into the manufacture of the blade, and the consequent ignoring of the purposes for which it was intended, will make the test, if not directly misleading, at least of doubtful or little value so far as that particular blade is concerned and will result in conclusions being drawn which are unfair to the maker of the saw. Where definite recommendations as to the use of a saw are not made by its manufacturer, some confusion as to the conditions under which it should be tested may be avoided by identifying it by means of gage and pitch, with a blade whose proper use is known, and testing it according to the instructions for that blade, as given in the Hack Saw Chart on pages 22 and 23 of the book, "Hack Saws and Their Use," published by The L. S. Starrett Company, Athol, Mass., for free distribution. A copy of the Starrett chart will be sent free upon request.

stant for 30 minutes. Inasmuch as the butter has melted by the time temperature attains 146 degrees, the pasteurization of the skimmed-milk-butter mixture begins when the correct temperature is reached. While at the pasteurizing degree of heat, the fluid is conveyed through the centrifugal emulsors. Emulsification is the result of forcing the mixture through an extremely narrow opening, the centrifugal force being generated by revolving the bowl of the emulsor at a rate of 15,000 revolutions a minute.

From the emulsors the hot fluid or reconstructed milk is conveyed to the upper trough of the cooler through sections of 1½-inch sanitary milk pipe to which had been attached small conductor heads. Foam multiples at this juncture, and to avoid its overflow at the edge of the conductor head and trough, the installation of an antifoam tank between the emulsor and cooler is recommended by the sanitary engineers. If the milk leaves the cooler at a temperature of from 40 to 50 degrees Fahrenheit, one of the standard requirements in the process of manufacture has been met. Proper regulation of the temperature as the milk departs from the cooler is essential; therefore, the flow of brine should be regulated so that a minimum quantity of milk freezes to the cooler. An antifoam tank in the Nitro plant, the device being inserted between the cooler and the can and bottle fillers, eliminates the presence of air space between the cap and the surface of the milk when the bottles are filled directly from the cooler. The commonplace procedure of filling the containers with a rotary bottle filler is the succeeding process, and having been capped with paper caps, the finished product is conveyed by motor trucks into the cold-storage room, subject to a temperature of 33 degrees Fahrenheit, until delivery is authorized.

The reconstructed milk as manufactured under war-created difficulties contained 9 per cent milk solids not fat and 3½ per cent butterfat. The cream contained 25 per cent butterfat. Studies of the bacterial content of the output of the mechanical dairy indicate that it is satisfactory from a health standpoint. Ice-cream can be manufactured in quantity production with a bacterial content comparing favorably to that of well-pasteurized milk and cream. Conclusions, carefully deduced from seasoned experiments, indicate that children can be nurtured on reconstructed milk as well as on normal cows' milk. Adult milk drinkers, used to drinking raw milk, will find the product somewhat distasteful, but those in the habit of partaking of pasteurized milk can switch to the newly-discovered fluid without observing an appreciable difference in flavor.

Stopping Our Coal Leaks

(*Continued from page 325*)

hour service, or 36 million horsepower for an 8-hour working day.

It is obvious that we never could completely accomplish this; but even if we recover only one-quarter, or even only one-tenth of this waste, it would be a vast increase in our national efficiency.

Here is one way in which this can be accomplished: Of the hundred millions tons of coal, which are annually consumed for heating purposes, most is used as steam heat. Suppose we generate the steam at high pressure—as is done now in many cases for reasons of heating economy—and interpose between steam boiler and heating system some simple form of high pressure steam turbine, directly connected to an induction generator, and tie the latter into the general electrical power distribution system. Whenever the heating system is in operation, electric power is generated, we may say as a "by-product" of the heating plant, and fed into the electric system.

The power would not be generated continuously, but mainly in winter, and largely during the day and especially the evening. That is, the maximum power generation by such fuel power collecting plant essentially coincides with the lighting peak of the central station, thus occurs at the time of the day and the season when power is most valuable. The effect of such fuel power collection on the central station should result in a material improvement of the station-load factor, by cutting off the lighting peaks.

It is interesting to note, that even with a very inefficient steam turbine, the electric generation of such fuel power collecting plant interposed between boiler and heating system, takes place with practically 100 per cent efficiency, because whatever energy is wasted by the inefficiency of the steam turbine plant remains as heat in the steam, and the only loss is the radiation from turbine and generator, and even this in most cases is useful in heating the place where the plant is located. The only advantage of a highly efficient turbine is that larger amounts of electric power can be recovered from the fuel, and the question thus is that between the investment in the plant and the value of the recovered power.

The Sailing Ship's Return

(*Continued from page 326*)

of free power in a way which it lies within our ability to do?

The art of sailing-ship design reached its pinnacle in the fifties of the last century. Many a brave clipper-ship in those days raced westward around Cape Horn, or out to the China Sea, making for days on end a sustained speed of from 13 to 15 knots—a speed which would leave the average freighter of today very far astern: and the thing can be done again. Only today the ships must be larger and they must carry smaller—far smaller—crews.

However, both of these conditions can be fulfilled: the use of steel and our better knowledge of the strength of materials make the first possible, and our wonderful assortment of labor-saving devices permits the second. It is merely a case of experiment and adaptation.

With this in mind, Mr. Liljegren has developed the scheme for a most interesting type of ship. To an American she looks not unfamiliar, for she is essentially a big five-masted schooner, resembling closely the large coasting craft that are so common a sight to all who visit our Atlantic shores during any summer season.

This particular ship is, however, to have some interesting modifications of design, both in hull and in rig. The one which first strikes the eye is the division of the big fore-and-aft sails into an upper and a lower half for greater ease in handling. Furthermore, the actual handling of sail will be done to a very large degree by machinery, thus reducing the crew to the minimum number. A steam or motor winch is employed in our present big schooners for hoisting the sails, but Mr. Liljegren proposes to go a long step farther and install a "unit system" of electric-motor winches—a separate drum winch to each halliard and sheet on the vessel. These motors may be controlled from the quarterdeck by the mere throwing of a switch; so that, for all ordinary operations save reefing, the officer on watch and one hand, at the wheel, will actually be all the persons needed to handle the ship.

Power for these labor-saving devices is to be supplied by a Diesel engine driving a generator. This engine will also serve to propel the vessel at a moderate speed in calms, thus overcoming the one great drawback of the sailing ship, that of time loss on routes where belts of prevailing calm and light airs have to be traversed. Besides these two principal uses the vessel's power plant will run the cargo hoists, and supply light.

Structurally it is interesting to note that the designer proposes providing this ship of the future with a pair of weighted centerboards, one forward and one aft, to improve her sailing powers by reducing leeway and also to increase her stability when "flying light." Her he has ob-

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viously taken a leaf out of the yachtsman's book, for no merchant vessel of more than 500 tons' register has ever been built with anything resembling a centerboard.

This is all most interesting, the new departures and "gadgets" not least of all; but one who has had practical sea experience in modern sailing vessels cannot help wondering if Mr. Liljegren knows that a smart Yankee five-master of the present day can show her heels in a breeze quite easily to the average tramp steamer and that she can, even today, make money at rates under which the tramp is unable so much as to pay for her coal.

No doubt some further refinement in design and the addition of practical labor-saving devices, such as wire running gear and drum winches would make her still more economical. Perhaps, then, the solution of the ocean freighting problem is even nearer than we realize. Possibly in another five years we shall see the lofty topmasts of the ships from Bath and Boothbay crowding the harbors where almost a century before the Yankee clipper was proclaimed queen of the Seven Seas.

Cinematography at the Winning-Post

(*Continued from page 327*)

justing the width of the shutter slots, be taken out of the case.

After thus getting the five-fold camera into order, it is inserted into the case fixed by means of the bracket to the judge's stand. This comprises an additional objective shutter, the variable position of which is indicated by two red discs and one rectangular yellow plate and which is intended to prevent the production of a veil on the highly sensitive photographic plates.

The apparatus should be so inclined as to point the central objective toward the central part of the race course, after which the adapter with the plates inserted is introduced into the camera. In order to protect the plates as long as possible against any false light, the adapter slide should not be drawn out until the horses have been taken to the race course.

The apparatus is started electrically by means of a switch from a point situated about 3 meters away from the winning post. As the horses are appearing at about 50 meters before the winning post, the switch-lever is operated, thus opening the additional shutter by means of the current coming from an accumulator battery. The yellow plate now disappears, whereas the red disc becomes visible; the lever should be at once returned into its position of rest.

When the horses have arrived at the auxiliary winning post line, 3 meters in front of the actual winning post, a short pressure on the key fixed at the right side of the switch will open successively the five objective shutters.

This method is based on the fact, brought out by experience, that there is for the observer entrusted with the opening of the objective shutters, one especially advantageous spot where the time error no longer matters. When the observer is posted quite close to the winning post he will appreciate only inaccurately the moment when the horse's nose is passing through the plane of the latter. As his distance increases the accuracy of his appreciation will first increase and eventually decrease again. In the interval there is some "optimum" point where the individual error of appreciation is least, but which, of course, varies somewhat from one person to the other.

Inasmuch as the few plates required for the process can be developed in the judge's stand, and as any photographically skilled observer, even before the developing of the plates is completed, will discern all essential data, the judge's verdict can be given out by the time the horses are returning to the scales, and as a special

process allows the plates to be enlarged while yet wet photographs of a size of 40 by 50 centimeters can shortly afterward be hung up at some suitable place and made visible to everybody.

Hydroelectric Power in Argentina

(*Continued on page 330*)

What the government will do with this scheme remains to be seen; but private electrical engineers in Buenos Aires are not so confident of its success as are Government officials. Critics of the project do not dispute the figures given in the report, for the simple reason that no independent investigation has been made; but they do question the soundness of the conclusions arrived at on the technical side. To transmit power 750 miles to Buenos Aires, which must be the manufacturing center of the republic, is not regarded as practicable. If it can be done then it will be the biggest undertaking of its kind that has yet been attempted. The economic aspect of the scheme is viewed with grave doubt. As an electrical engineer pointed out to the author the Iguazu proposal differs vastly from that centering round Niagara. There the transmission of current does not mean anything like a distance of 750 miles. The power of Niagara is utilized by dozens of cities and towns comparatively close to the generating center, and there is no dearth of customers. Between the Iguazu Falls and Buenos Aires there are only two or three large cities which are likely to develop into manufacturing centers, and not one of them is less than about 500 miles from the falls. The idea that the inland railroads will electrify their systems and so become customers is scouted. In and around Buenos Aires electrification has gone on, but the day when anything more than the urban and suburban traffic lines will be worked electrically is considered to be too far ahead to admit of useful discussion just now in connection with the Iguazu scheme.

"I will tell you what there is to this scheme," said one engineer. "In the first place it is an international problem in one sense. The falls divide Argentine and Brazilian territory. Before anything can be done the two countries which have equal rights to the water must agree, and if Brazil has the same ambitious notions as Argentine she is going to demand half the power. That means that Buenos Aires or other centers can only get half the energy, so that instead of 125,000 kilowatts there will be 62,500. If that could be transmitted 750 miles, which I do not believe is at present possible, the unit of energy to the city would be proportionately more costly.

"The engineering side of the scheme, outside of the transmission problem, only presents one difficulty, and that is in the variation of the head of the water due to the rise and fall of the river, there being a difference of as much as 100 feet in the head. Otherwise there is no great problem, though the job will be very costly. The river can be dammed, according to the Government engineers, and a canal will then have to be cut some kilometers through Brazilian territory, to convey the water to the power station which would be located below the falls.

"I estimate roughly that electrical plant and material worth $30,000,000 gold will have to be imported, if the scheme ever goes through, and I suppose this will be bought in the United States. I don't know that any private company will be given the chance to take up the scheme, it being generally accepted that it must be a State undertaking, but if the chance were given I can't imagine any private engineering concern tackling a job which does not look to me like giving practical results in this or the next generation. The Government need not look on the undertaking in this way. First it can raise the money it wants cheaper than a company could, and second it does not necessarily require direct and immediate financial results. Governments look for broad indirect benefits from such schemes, and don't mind losing a few millions in the early stages of operation. Even so I consider the Iguazu proposition is one that will not be realized in our time."

That, of course, is a private opinion, and it does not coincide with the Argentine idea of what is practicable and what is not. Some day the generating of electrical energy at the great falls, and its transmission to Buenos Aires will be a practical scheme, if it be not so today. And the Argentine in his enthusiasm will never object if the anticipation of that day by ten, or a hundred years, costs his country a few millions of dollars. He would willingly face the loss if it meant a solution of his fuel problem.

A Hospital for Mail Bags

(*Continued from page 332*)

offices. Consequently, renovation is the first task of the salvage department in rescuing the sacks to useful service. Two tumbling barrels have been set up by the mail equipment shops for this specific purpose. They are built in the form of a star which revolves, the bags tumbling from one point of the star to another. The dust is beaten out through slats, of which the barrel is constructed. The space on the outside of the tumbling barrel is boxed in the form of a closed room with a large pipe running therefrom to a canvas bag located outside of the building. A powerful suction fan has been installed in the pipe and by its operation the dust is drawn from the boxed-in room to the canvas bag referred to above.

Sacks consigned to the mail equipment shops, subject to salvaging, are first inspected and assorted according to the following classifications: Serviceable, condemned, machine repairs, stringers, and patches. Their respective needs are thus identified. Bags subject to patching are further inspected by patch-fitters who salvage a good head from one ill-handled unit and a sound bottom from another "bum," and thereby refashion a standard size sack. Machine operators sew the units together into a compact container. Some 200,000 remodeled bags are thus salvaged to the postal service annually, which otherwise would represent a loss. The life of the made-over container is about two years, many of them capable of rendering service equal to that of new ones.

Repairs, insofar as practicable, are made by sewing machines. The work as it leaves the machine is assorted into finished and unfinished piles, the former being immediately packed for shipment and the latter redistributed to hand darners who sew up any holes around the metal eyelets which machine operation was incapable of doing. Bags classified as "stringers" are distributed to workers whom the designation implies, who renew lacing cord, etc. Condemned bags, pronounced altogether unserviceable, are mutilated into scraps and marketed as "junk" under contract to the highest competitive bidder.

Labor is employed to divorce the metal parts from the leather and canvas, experience having justified as a profitable method the sale of the same separately rather than as unclassified waste. Including the cost of labor, material, expense of stringing, etc., it is computed that sacks are salvaged for less than eight cents apiece, with an estimated saving of $443,677.81 for the past fiscal year to the Government.

Fossil Footprints of Texas

(*Continued from page 333*)

other parts of the body showing the texture of the skin. Later, parts of skeletons were found in the rocks thus giving the first positive confirmation of the presence there of dinosaurian reptiles.

Other attendant phenomena have left their records such as the rain drops of a summer shower, ripple and beach marks. These are sometimes preserved with wonderful fidelity and minuteness of detail. In the National Museum at Washington is a slab of these Connecticut Valley footprints showing tracks of two three-toed reptiles crossing it, one made before, and one after such a shower, as shown by the presence of rain drop impressions on the one and their absence on the other. Of course, all of these imprints were made when the sediments were yet soft mud and before they were consolidated into hard rock as we see them today. That some people do not understand this is indicated by the conversation of two countrymen standing before a large slab of footprints in the National Museum. One of the men, after hastily reading the label, was overheard to remark to his companion, "That must have been a durned heavy critter to push his feet down into the rock like that."

The amount of information to be gained by a study of a slab of these foot impressions is interestingly told by Prof. R. S. Lull. He says: "One extremely interesting specimen in the Amherst College collection bears in all about fifty impressions (sketch reproduced herewith), most of them made either by the same animal walking back and forth along the beach or by several of approximately the same size. In one of his journeys the creature slows down as shown by the fact that the tail begins to drag, whereas it has been held out stiffly behind to counterbalance the weight of the body. Then the animal stops and comes down on all fours impressing the little hands and long heels, then having satisfied his purpose, it rises again to its hind feet, touching one hand and the tail tip once more to the ground regaining its balance and then goes on its way. The single slab gives us thus a knowledge of the creature's size, proportions, gait, resting posture, feeding habits for the little hand with its nail-like claws could never have been used for grasping prey, and finally, the texture of the skin on the soles of the feet with creases between the joints, like those of the human fingers, and tiny granulations like mustard seed covering the entire surface."

Geologists picture this region at the time these tracks were made as a tidal estuary. In places in this estuary were flats, some well out in the ancient bay, others nearer shore, which were left bare by the receding tides. Here the animals congregated, possibly they came for food. The impressions made when the tide ebbed were baked by the tropical sun and thus somewhat hardened before the incoming flood bearing its burden of sediment gently buried the traces without injury, thus preserving for our enlightenment these evidences of past animal life.

It is some modification of the conditions pictured above that will account for the preservation of the Texas footprints. However, before much can be said of the reason for their preservation or the kind of an animal that made them they must be the object of special and detailed study, and it is hoped that the owner of the land will soon make them available to some scientific institution where they may be given the critical study necessary to properly interpret them, and also where they may be exhibited to those who may be interested in such evidences of the past animal life of this continent.

New Remedy for Healing Wounds

THE *Danish Weekly for Physicians* informs us that Dr. Fischer of Kopenhagen has succeeded in producing a liquid medium which is said to be exceedingly efficient in surgery. The new remedy, which its discoverer calls "Incotamin," consists of a pancreatic extract and a serum; the nature of this latter has not been definitely stated. The remedy has been most effective with wounds which showed a tendency to delay in healing. It has failed, however, with cancer, tuberculosis and syphilis wounds.

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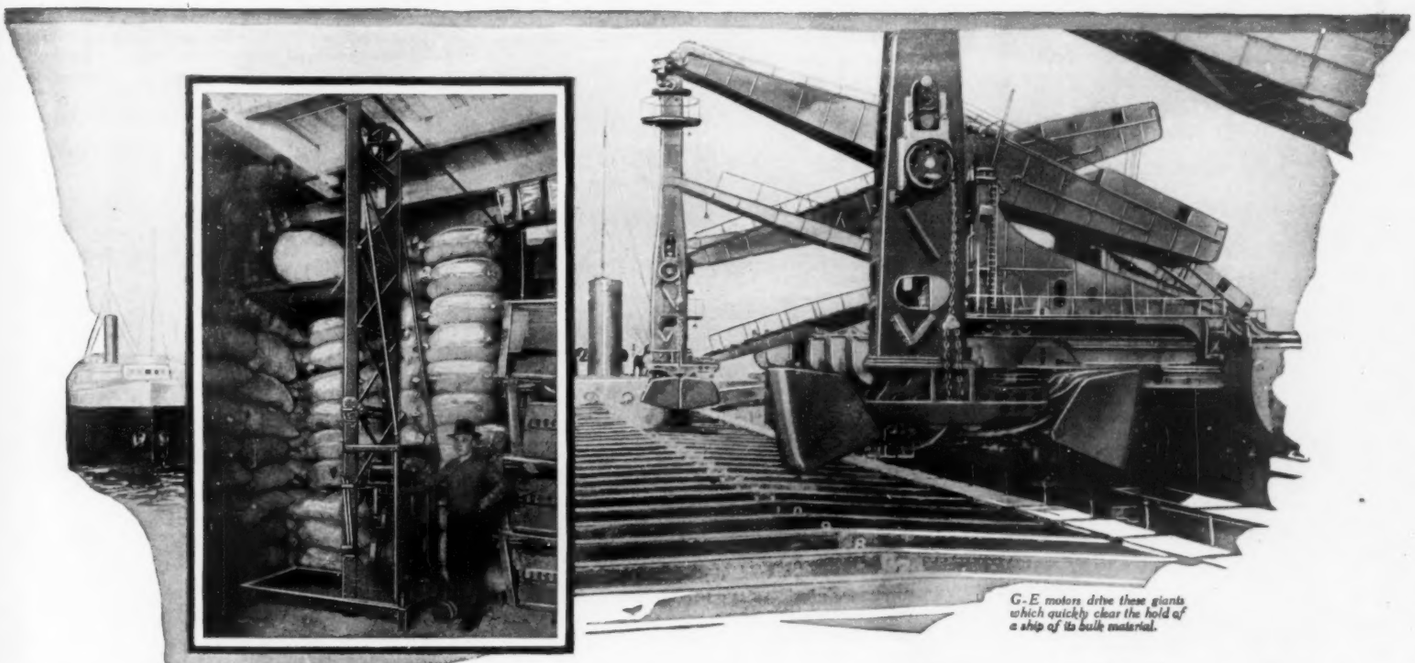

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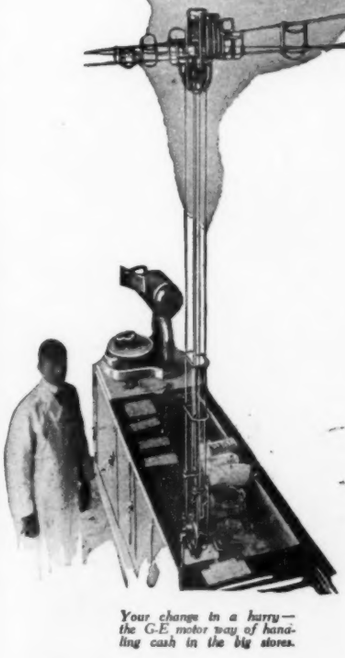

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